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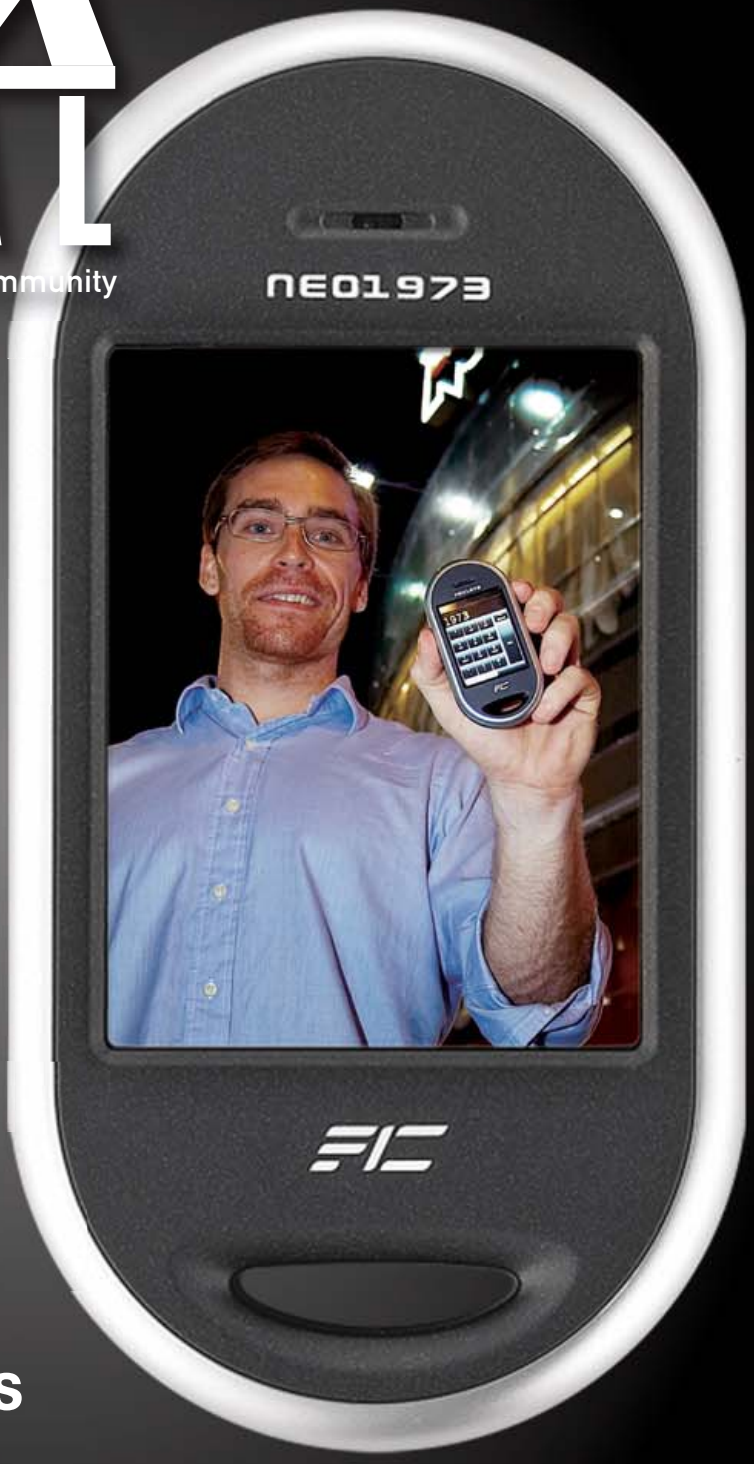
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DECEMBER 2007 | ISSUE 164

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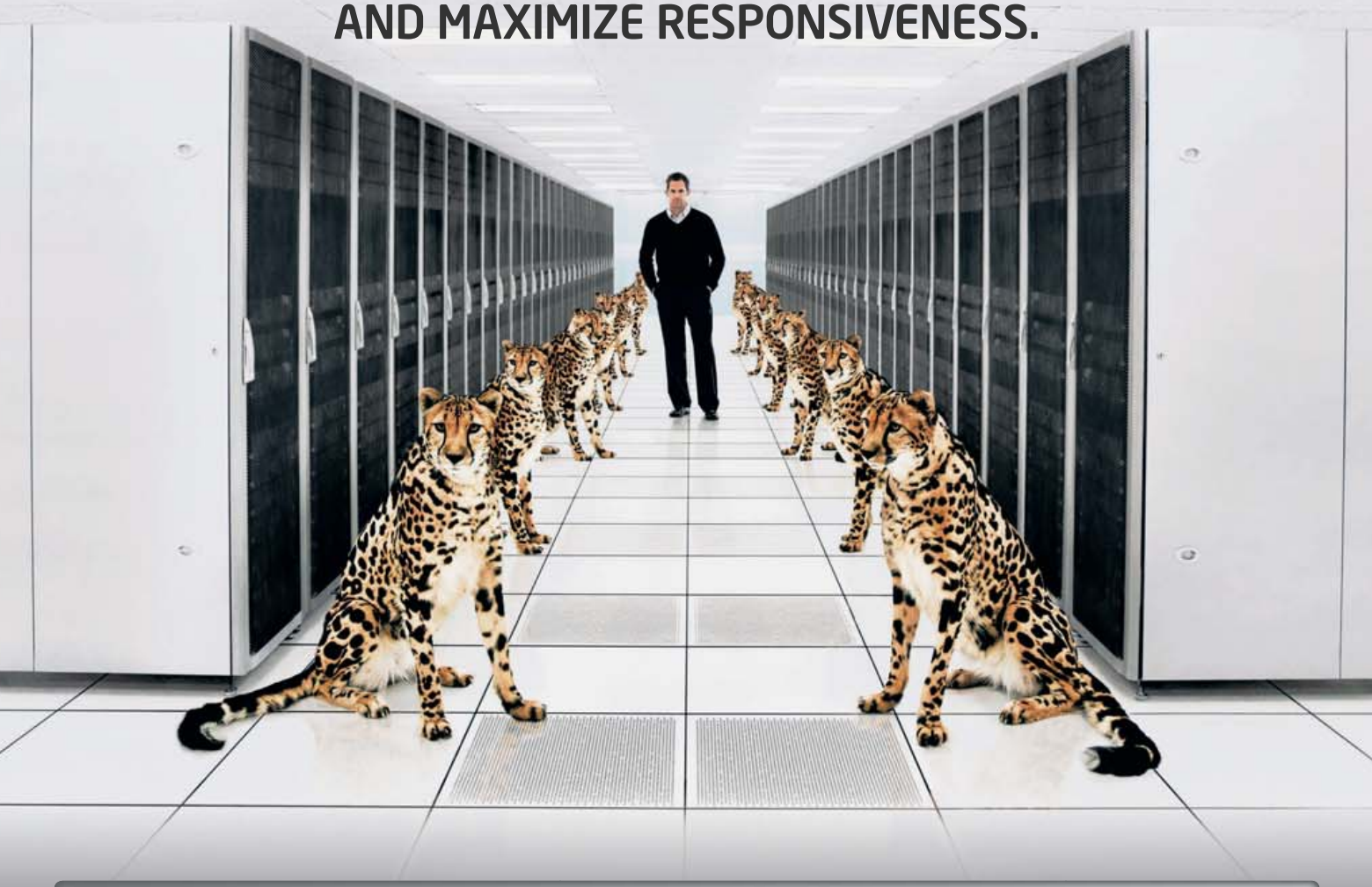
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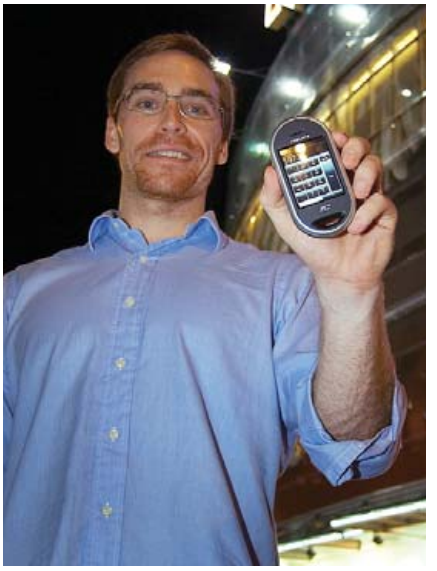
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SECURITY

Next month we welcome back Security Editor Mick Bauer and his Paranoid Penguin column, which will kick off the new year with a look at using WebGoat to help you avoid Web application security mistakes. Additionally, we'll take a look at improving system administration security tasks using the forensics tools Sleuthkit and Autopsy.

As always, there's much more. We'll cover building a GCC cross-compiler, and walk you through creating a GPG-based password wallet. We also touch base with Eric S. Raymond to see what he's been up to and his thoughts about open source in 2008.

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Security Editor	Mick Bauer mick@visi.com

Contributing Editors
David A. Bandel • Ibrahim Haddad • Robert Love • Zack Brown • Dave Phillips
Marco Fioretti • Ludovic Marcotte • Paul Barry • Paul McKenney • Dave Taylor

Proofreader Geri Gale

Publisher	Carlie Fairchild publisher@linuxjournal.com
General Manager	Rebecca Cassity rebecca@linuxjournal.com
Director of Sales	Laura Whiteman laura@linuxjournal.com
Regional Sales Manager	Joseph Krack joseph@linuxjournal.com
Regional Sales Manager	Kathleen Boyle kathleen@linuxjournal.com
Circulation Director	Mark Irgang mark@linuxjournal.com
Marketing Coordinator	Lana Newlander mktg@linuxjournal.com
System Administrator	Mitch Frazier sysadm@linuxjournal.com
Webmaster	Katherine Druckman webmaster@linuxjournal.com
Accountant	Candy Beauchamp acct@linuxjournal.com

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letters



Love Clippy Humor

I appreciated Nicholas Petreley's /var/opinion article in the October 2007 issue titled "More Power to Linux". The humor regarding "clippy" made me laugh. I also appreciate how you constructively showed where Linux advances could be made in the media sector. You identified some present possibilities for users and acknowledged development should continue, while you were not brash or critical of developers' efforts.

--
Valden

Doc Not Spun

To Doc Searls: As a longtime reader of *Linux Journal*, I certainly would like to congratulate you for the very many fine articles and interesting comments you have made over the years. Therefore, I am very sorry to write my first letter to you about something that is relatively unimportant, but it has really annoyed me. You wrote (or re-published under your own name), a small, shameless piece of advertorial for a gadget called a Chumby (September 2007, UpFront section). Okay, that's fine, that's what media does; equally, my appreciation would be heightened immeasurably if Giselle Bundchen was photographed wearing a Tux T-shirt, and the photo were published with your commentary (or any commentary really) in *Linux Journal*. But what annoyed me about the Chumby is that it is not even available! Why are you telling us about some gadget that, so far, is still on some assembly line in a Chinese province? Oh, and your advertorial missed the bit about Chinese manufacture—wouldn't fit with the PR I suppose! Shame on you for falling for the spin!

--
Fred

Doc Searls replies: *Thanks for writing. In UpFront, where the Chumby piece ran, we like to post about interesting stuff that may not (or may not yet) warrant full-length coverage in the main body of the magazine. UpFront is where we put "light news" and regular features (They Said It,* LJ *Index), where we get to have a bit of fun with one thing or another. Having fun was hard to resist with Chumby, which (as I recall) I found on my own—not through the company's PR system. I don't know anybody at Chumby and have not spoken to anybody there. Perhaps I should have, but that's a different matter. The point I want to make here is that I was not "spun" by the Chumby people or its propaganda apparatus. And, far as I know, I have nothing to be ashamed of.*

It's important to note that we have a lead time of three months or more. This means we sometimes cover stuff that isn't out yet, or is due to be out before the magazine appears in mailboxes and newsstands. In cases like those, we qualify what we say. In this case, here's what we said: "If all goes according to plan, Chumbys should be on the market by now. Prototypes and development versions have been circulating for about a year, and a sizeable development community has grown around it. Given how much it's grown and changed in the public womb, there's no telling how it'll evolve out in meet space."

For those interested in Chumby, this puts a spotlight on the stage of time. If Chumby fails to show up and perform in that spotlight, that's not a good thing for the company. There's an old saying: "Nothing will kill a bad product better than good advertising." I don't think the Chumby piece I wrote was an "advertorial", but even if it was, the piece will embarrass Chumby if the company fails to deliver.

And has it yet? I just checked the Chumby Web site, and the company already has its "first 50" in the field. It also promises to start filling orders in September, which is also the cover date for the issue of Linux Journal *in which the Chumby piece appeared. Rather than acting like a large manufacturer that promises long and delivers short, the Chumby folks seem to be doing an earnest job of bringing a product to market. And they also seem to be far more disclosing about what they're doing along the way than any traditional consumer electronics supplier that comes to mind.*

But you are helping remind me that one does take chances when writing three months out about an undelivered product—or when waxing positive about something that may not turn out that way.

A few years ago, I enthusiastically covered a fun Linux hardware hack called Kerbango, which was to be the first Web radio. I thought it had problems: a proprietary and centrally controlled station database and limitation to the RealPlayer codec, to name two items. As a Linux Journal *editor and a radio lover, I very much wanted Kerbango to succeed. But the company sold out to 3Com, which killed it. Yet, did we have egg on our faces? I'm not sure we did.*

On your point about Chinese manufacture, I'm not sure I understand. Are you saying all Chinese manufacture is bad? Would you have us exclude or disclaim Chinese manufacture wherever it might be involved? I don't know, so if you could clarify that point I'd appreciate it.

I also thank you for your kind words about my other writing. I do value feedback of every sort.

Re: Chuck Adams' Letter, October 2007

There are several issues I would like to raise.

Number one: I quote from his letter, "I still wonder if people fully realize just how much compute power they have at their fingertips." Not only do they not realize,

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they do not care. My DVR contains more compute power than the first five computer systems I bought combined. Do I spend time concerning myself with that? Not hardly. My microwave oven has more compute power than the first computer system I ever bought. Can you guess how much time I spend thinking about that? For that matter, how much time do you spend thinking about the fact that most PLCs on a manufacturing floor have more compute power than IBM mainframes from the '60s?

Number two: I quote again, "We are trying to get all of human knowledge at the fingertips of every man, woman, and child on the planet. We are about to get there." This reeks of Socialist "nirvana" thought. We will never reach that goal until there are no longer any Communist, Socialist or any other forms of government where "the society takes precedence over the individual" exist in this world. In other words, until you stand up and fight for freedom of the individual over the government, this will never happen.

Number three: I quote again, "Get a thought to go where no thought has gone before." Get a grip. Fight against government control of people and the rest will follow.

--
Jeffrey Goddard

A Victory Lap for the Raven X60?

I enjoyed the idea of showcasing the Ultimate Linux Boxes [September 2007], but when I read the the laptop part of the article, I was left wanting to know who were the other contenders that the Raven X60 is running its victory lap against? There was mention of Dell disappointment, but none of the other Linux laptop contenders were named. Did the Raven run against itself, sort of like in local politics when there is often only one candidate running? I think the review would have been more convincing if it actually went head to head with the competitors.

Also, assuming the Raven X60 is the best, there wasn't a real compelling reason why consumers should purchase from EmperorLinux instead of getting an IBM ThinkPad X60 loaded with Redmond software and then just installing Fedora or Ubuntu themselves.

--
Chris

James Gray replies: *Thanks for your feedback, Chris. The way this competition worked is that we asked every vendor selling preloaded Linux laptops to send their best laptop selling for $3,000 or less. Several companies took us up on our offer. The EmperorLinux Raven X60 was easily the best machine out of those tested. Although I did not test every single laptop available from every vendor, I searched around quite thoroughly to be sure I didn't miss anything that looked, at least on paper, to offer the Raven a very serious challenge. Given the excellent work that EmperorLinux does to enable Linux functionality on this machine, especially related to the tablet, in the end I felt confident granting the title of Ultimate Linux Laptop to the Raven X60. I know I would be hard-pressed to get all of that functionality going if I installed the Linux OS myself.*

On TiVos

Regarding Nicholas Petreley's "The Ultimate Linux PVR" [September 2007], I am glad you like your TiVo, but do not confuse your satisfaction with TiVo as a product with GPLv3 issues. As a product, it is not relevant what OS a TiVo runs. And, your happiness with the TiVo has little or nothing to do with what OS it happens to run.

The issues the GPLv3 raises with TiVo have nothing to do with whether the TiVo is a good product, but whether TiVo's use of Linux was consistent with the principle of Free Software. TiVo may well be an excellent product, but it violates the spirit and principles of the GPLv2 if somehow it might conform to it by the letter of the law.

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There is nothing wrong with TiVo's approach to PVR. If TiVo had developed its own OS, used BSD as a base as Apple did or bought an OS from any of a number of other sources, it would do everything it does now. In fact TiVo probably could have been developed without an OS at all. But TiVo did not do any of those things, it picked Linux. When companies base their business model on the use of Linux and other open-source software, we applaud them. We also expect them to play by the rules and principles of open-source software.

There will not be some major Linux fork over TiVo. Most of the debate over the GPLv3 is overblown. It is unlikely that Linux will convert to a GPLv3 license. But the Linux kernel already has parts under different licenses, and it is equally unlikely that Linux will remain permanently GPLv3-free. Further, Linus needs to figure out whether the principles of the GPL actually mean something, or whether Linux is just another BSD variant of sorts—only more popular.

The principles of FOSS and the GPL (all versions) have always been that completely free and unrestricted software—even if that means lower quality, less functionality or less popular acceptance—is better than unfree, partially free or even mostly free software. There is even a fairly credible argument that without completely free and unrestricted software, all partially or mostly free software will eventually become proprietary. TiVo just represents one way in which that can happen.

--
David

Keep an Open Mind

I read Nicholas Petreley's /var/opinion "The Ultimate Linux PVR" [September 2007] with some interest. It was not what I was expecting to see. Like you, I've had a love/hate relationship with MythTV over the last two years or more, which centered around the problems relating to HD content. However, you may have left your readers with an overly pessimistic view of the HD landscape.

First, using a DVB tuner card, it is possible to capture either OTA HD content, assuming you are in a good area for local reception, or to receive unscrambled QAM signals from your cable provider. I don't understand why you were unable to get some OTA HD channels using the cards you mention. I will agree that does not give you any of the premium content that cable service is providing.

Second, we have the FCC to blame for the current situation as much as the cable services and the content providers. See the *TV Technology* article, **www.tvtechnology.com/pages/s.0082/t.6899.html** for some background. Briefly, cable providers were not required to support CableCARD technology until July 2007. If you read the article, what it really says is that they were not permitted to distribute STBs where the security is integrated after July 2007. CableCARD is not more widely available and supported because integrated security was allowed. Indeed, some of the MSOs have been given additional waivers even though they've had a long, long time to prepare for it!

Finally, ATI has just announced the first CableCARD/USB tuner; see **ati.amd.com/products/tvwonderdigital/index.html**. I can only assume there will be more devices from other companies. Hopefully, one or more will provide Linux drivers so that it can be incorporated into software like MythTV. It won't happen overnight and, unfortunately, ATI's other USB tuners are not currently supported. I agree, for the individual who just wants a PVR, it's probably easier, and cheaper, to pay TiVo than it ever will be to put together a MythTV box. The solution has some limits, however. For one thing, unless you hack your TiVo, there's no way to get your content out of the box (except to view it onscreen). I like to be able to archive my content. Second, for a box designed to record HD, the limit of 20 hours seems pitifully small. Large disks are cheap these days, but the eSata connection on your TiVo is (according to the Web site) not supported (yet).

Please keep an open mind on Linux PVRs. We need to see more articles on this multimedia convergence. Projects like MythTV and MPD need the interest generated by *LJ* articles. Keep up the good work.

--
Frank Pirz

Non-Ultimate Keyboard

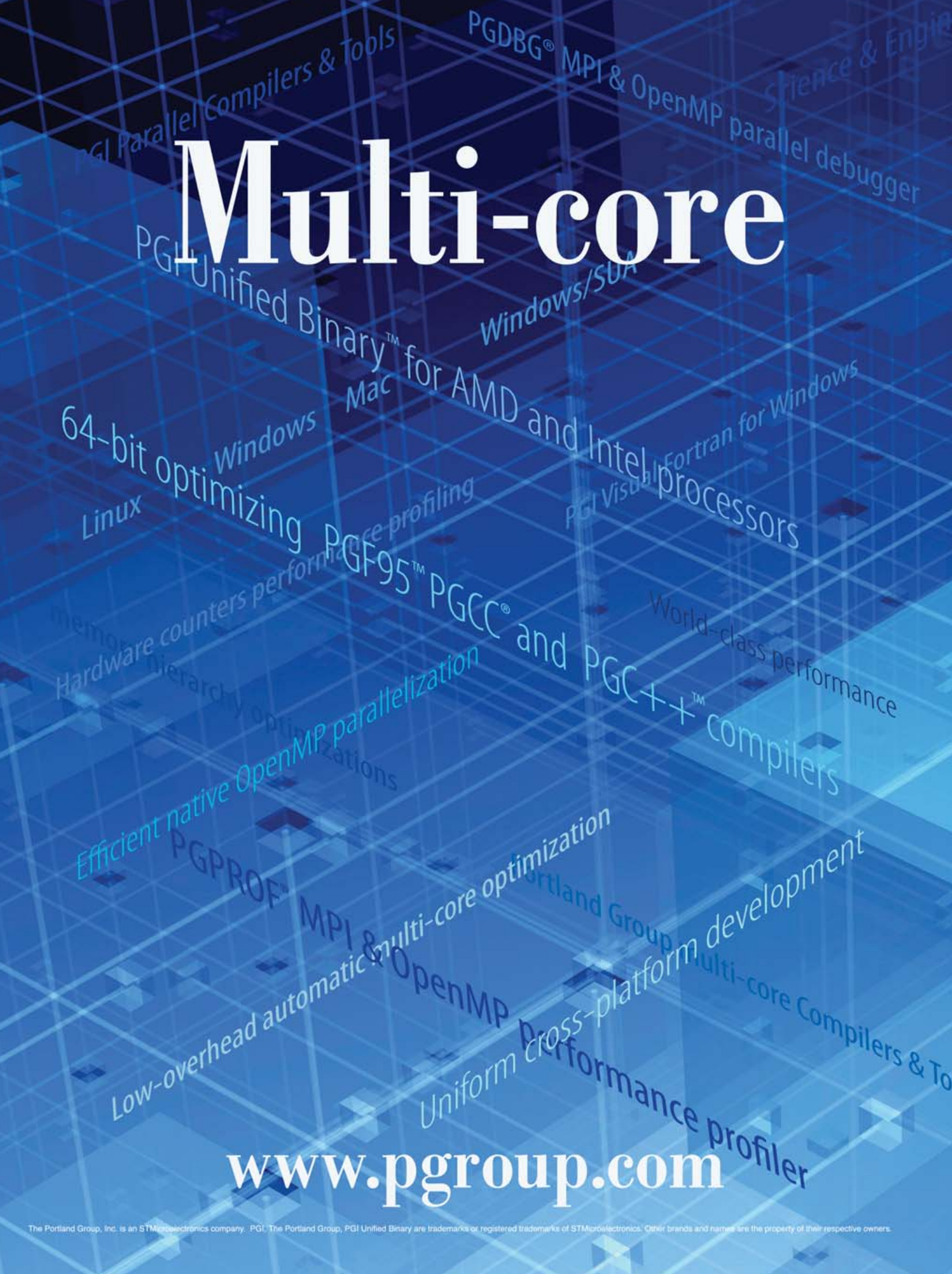
I love your hardware reviews, but I have to object to the Microsoft keyboard attached to this year's Ultimate Linux Box [September 2007]. It's not the brand name or the absurd price. But, calling that particular keyboard "ergonomic" helps obscure what truly ergonomic keyboards *were*. The MSFT "Natural Touch" is a hard stop, and hard stops cause carpal tunnel syndrome.

The original IBM PC keyboard was supposed to feel like an IBM Selectric. Selectrics were slow but very familiar, and people were already complaining about repetitive stress injuries from using them. But Boca Raton thought a familiar keyboard "feel" would help the PC get accepted. When the clone market took off, that exaggerated key clack evolved into a hard stop, leading to a carpal tunnel syndrome epidemic. Clones that weren't "100% compatible" didn't sell, so the Taiwanese manufacturers dared not make a keyboard that was "different", and they still don't.

It's a real shame, because by 1983 there were keyboards on OEM character terminals with very nice soft key-travel stops. I'd pay at least a hundred bucks for a PC-compatible version of the keyboard from my little Convergent Technologies 286 thin-client workstation, and twice that if it had a hinge in the middle like the Goldtouch I'm using now. Alas, the Goldtouch has a hard stop too. Apple's keyboards aren't much better.

Convergent's key travel was half that of the Selectric/IBM-PC's and landed with a definite tactile feedback that's hard to describe. You knew you'd struck the key, but softly. You could type hard and fast all day on that thing and not feel it in the back of your hands, and it was nearly silent. I've traded e-mails with the ergonomics "experts" at Goldtouch and ALPS, and they don't know what I'm talking about—yet another worthwhile technology swept aside by a monopoly player.

--
Cameron Spitzer



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diff -u

WHAT'S NEW IN KERNEL DEVELOPMENT

Every once in a while, someone tries to shrink the kernel by removing support for something old. Typically, a lively debate ensues, and the end result usually makes sense. This time, the question was does the kernel really need to support versions of **GCC** older than 4.0? The answer, apparently, was yes. At least for now, **Linus Torvalds** feels that end users could be using a wide variety of compilers, and those users should be encouraged to compile their own kernels and report on any bugs they discover. The fewer folks compiling their own kernels, Linus said, the fewer bug reports come in, and the less the kernel developers can rely on a global base of testers.

Adrian Bunk was the main proponent of ditching the older compilers. Adrian is one of very few people who put serious time into cleaning up the kernel sources. He's pointed out that eventually some reduction in the number of supported compilers will be necessary to reduce code complexity. The only question then is when would the developers have to do it. He's also made the case that by supporting all of these different versions of GCC (and other compilers), any particular bug might be tightly related to both the kernel version and the compiler version, in which case, it would be much less likely that the bug would be fixed, or even verified, by anyone in a position to hunt for it.

Folks like **Russell King** and **Kyle McMartin** have made the practical point that GCC 4.0 is still unstable on the **ARM** and **PARISC** architectures. GCC 3.4 also runs faster and generates better code. To this, Adrian countered that the kernel could still ditch support for older compilers under architectures other than ARM and PARISC. He had no counter to the "better code" argument, but maybe the difference in code quality would not really be so significant, considering that most kernel developers use GCC 4.0 anyway.

So, Linus' verdict is in. At least for the moment, older compilers will continue to compile the kernel. But, for those of you stuck with a development environment that requires these older compilers, you probably should start working toward an upgrade before the hammer falls.

It's always nice to see accessibility improvements in the kernel, as it is elsewhere in the world. **Samuel Thibault** recently extended **Linux Braille** support to a ten-dot keyboard, allowing a 1,024 character font. Up until now, Linux has supported only eight-dot keyboards, with 256 character fonts.

Okay, you've written a new kernel patch, now to whom do you send it? If you don't know already, finding out could be an arduous process. No more! **Joe Perches** has laboriously gone through the entire **MAINTAINERS file** and added fields to each feature entry, showing which source directories that feature affects. He's also written a script to analyze your patch and tell you exactly where to send it. Presto! Everyone's life just got easier.

Evgenly Polyakov has been working on a **distributed storage system** (DST) that would allow multiple systems anywhere on a network to act as a single directory tree. Maintenance and recovery are a big part of his design, so it should be feasible for users to rely on the directory hierarchy even when some directory "nodes" have to be taken down for maintenance or if their Ethernet cable falls out. There's been a lot of interest in Evgenly's work, particularly by folks like **Daniel Phillips**. Daniel intends to go through all the code thoroughly with **Peter Zijlstra** to make sure there are no memory deadlocks or other gotchas. The code still is quite new, so you probably shouldn't go trusting your data to it quite yet. Once it's ready, it should be quite impressive though.

Rik van Riel has set up a **Japanese language kernel mailing list** targeting kernel newcomers. The URL to join is **lists.kernelnewbies.org/mailman/listinfo/jp-kernelnewbies**. His hope is that Japanese developers may find this a more accessible entryway into kernel development.

—ZACK BROWN

LJ Index, December 2007

1. Lower limit of the percentage of Internet traffic identified as peer-to-peer: 50
2. Upper limit of the percentage of Internet traffic identified as peer-to-peer: 90
3. Lower limit of the percentage of peer-to-peer traffic that uses BitTorrent: 50
4. Upper limit of the percentage of peer-to-peer traffic that uses BitTorrent: 75
5. Percentage of surveyed Americans who believe the Constitution establishes a Christian nation: 55
6. Number of times the word "Christian" appears in the Constitution: 0
7. Number of times the word "God" appears in the Constitution: 0
8. Number of times the word "liberty" appears in the Constitution: 3
9. Number of times the word "freedom" appears in the Constitution: 1
10. Millions of Belgian student records managed by an open-source business process management suite (BPMS): 1
11. Thousands of schools involved in the Belgian BPMS: 3
12. Thousands of customers for Intalio, the open-source developer of the Belgian BPMS: 10
13. Share price in cents for SCO the day it filed for Chapter 11 bankruptcy protection: 37
14. Millions of dollars Rackspace will invest in its new San Antonio headquarters: 100
15. Thousands of new employees Rackspace intends to hire at its new headquarters: 4
16. Thousands of hostnames housed in Rackspace data centers: 920
17. Years Rackspace has been on Netcraft's radar with Linux Web servers: 11
18. Percentage of IBM System z mainframes expected to carry Linux workloads: 25
19. Percentage discount pricing on System z mainframes specialized for Linux: 90
20. Number of servers IBM is consolidating onto 30 System z mainframes running Linux in Project Big Green: 3,900

Sources: 1, 2: Ipoque.com, sourced by ArsTechnica.com | 3, 4: Ellacoya Networks, sourced by ArsTechnica.com | 5: First Amendment Center 6–9: USConstitution.net | 10–12: Intalio, Inc. 13: TheStreet.com | 14–17: Netcraft.com 18, 19: searchenterpriselinux.com | 20: IBM

A Business Case for Linux at Scale

The trick with what we call scale is an alignment of technology, use and business models. For example, the Linux kernel itself has no business model, any more than does geology or the periodic table. What we call kernel space is low-level, foundational. In that role, it supports the vast region we call user space. This is where applications live. Here, there may or may not be business models. Apache itself has no business model, although it supports all kinds of business through its enormous "because effects". That is, far more money is made *because of* Apache than *with* it. However, there still is plenty of money to be made with Linux, Apache and other foundational members of the LAMP stack, especially if you provide those foundations in reliable ways at costs lower than customers would pay to do it themselves.

Yet, DIY always has been at the heart of Linux Love, going back to when Linus Torvalds DIY'd Linux in the first place. That's why the sweet spot for large providers of Linux servers is to make DIY easy for experts and the customers of experts. The hosting business has been doing this since the dawn of the ISP. But, lately, Amazon has taken fresh advantage of its own scale as a huge company by providing limitless low-cost storage and compute foundations through AWSes (Amazon Web Services), best known as S3 (Simple Storage Service) and EC2 (Elastic Compute Cloud). With these, Amazon offers storage and compute power as raw utilities akin to electric, gas and water services. Will S3, EC2 and its inevitable competitors support the same kind of growth in the virtual world that those more elemental utilities have long supported in the physical world? So far, it looks like the answer is yes.

Let's take one DIY example from the far end of user space: creating audio and video productions. Here, we have a startup called Animoto (**www.animoto.com**), which mashes the skills of experienced TV and film producers with users' videos, music and images. At the back end, Animoto uses both S3 and EC2. Connecting Animoto's front and Amazon's back ends is a new company called RightScale. Thorsten von Eicken, CEO and founder of RightScale, says his company "provides the management platform, expertise and key critical components (load-balanced Web front end, MySQL master/slave, grid manager) to help companies focus on their core competencies that differentiate their businesses rather than the 'muck' of infrastructure".

So, how exactly does RightScale do the mucking for the likes of Animoto? Here's Thorsten von Eicken again:

> We provide a server deployment and management platform that provides open deployment recipes that users can inspect and customize. We call this "open deployment". For example, we just made a "Rails all-in-one" server template available that contains a dozen recipes for installing an entire Rails app stack on an EC2 instance, from front-end load balancing across the Rails app processes to MySQL and periodic backups to Amazon S3. Each of these recipes is a shell script that installs some RPMs and customizes the installation for Rails. As a whole, the server template allows users to simply plug in the SVN repository holding their Rails app and launch the server, all in less than ten minutes.
>
> But the point here is that users get not only the complete server template, but also all the recipes in open-source form. They can see how we install, say, Apache and set up the vhosts for ports 80 and 443 for their Rails app. If something breaks or they simply want to set up things differently (perhaps they don't want to redirect from HTTP to HTTPS automatically on the home page), they can clone our Apache config script, modify it and insert theirs into the server template. Now they have the same power, but customized.

Making this possible, in addition to the likes of Amazon, is a critical mass of open-source tools and building materials. But, even if the parts are free, the labor isn't. This is what creates opportunities for companies like RightScale. "Cloud computing on commodity hardware requires some rethinking: load balancing in software on 'front-end nodes', rsync-like backups to Amazon S3, dealing with dynamic DNS for round-robin DNS entries, coordinating servers in novel ways, and many more that can be solved by putting together pieces from the vast open-source toolkit and making minor changes where necessary", von Eicken says, adding, "Of course, RightScale, being a Rails site, is built 100% on open-source components, but which startup these days isn't?"

Which moots the question of how you can make money with Linux and open source.

—DOC SEARLS

They Said It

Even in cultures that place a high premium on wealth, people's most treasured possessions rarely have financial value.
—Sara Wedeman, behavioraleconomics.net

Imagine if Adobe went and open-sourced all the Flex components used to build Photoshop, Premiere and Illustrator? A whole new generation of on-line editing tools would be baked into social media apps and a whole new level of functionality would flower and prosper!
—Marc Canter, blog.broadbandmechanics.com/2007/09/what-adobe-should-do

Give a kid a firewall and you protect him for a day. Teach a kid to surf and you protect him for a lifetime.
—James I. Robinson, III, blog.robinsonhouse.com/2007/08/children-of-net.html

In matters of style, swim with the current; in matters of principle, stand like a rock.
—Thomas Jefferson, www.brainyquote.com/quotes/quotes/t/thomasjeff121032.html

Jon "maddog" Hall's Beachhead can be found on the *Linux Journal* Web site at www.linuxjournal.com/node/1000309.

TOP TEN REASONS You Should Load Linux on a Laptop

10 No more listening to monologues about the merits of Vista over Windows XP. As your friends describe the security improvements and begin salivating about the powerful new features, you can stop them cold by declaring, "I'm not upgrading; I'm switching to Linux." You'll have them high-tailing it out of your house screaming, "blasphemer!" The sight alone should be well worth it.

9 Installing Linux ensures that you will save yourself a bundle of money, not only at the register, but also in years to come—no need to pay for countless upgrades. Visit your favorite local computer retailer and drift through the aisles filled with various laptops. When salespeople approach you and begin touting why a certain laptop is a great deal because it comes with the Microsoft Office professional package, wave them off. Walk a little farther down the aisle; purchase the absolute top-end laptop that does not include any Microsoft applications. As the salespeople explain that you will be paying hundreds of dollars more because you will need to add Office, simply smile and pay with your charge card of choice.

8 End the constant late-night computer assistance calls from your "buddies". They call because, "you're the computer pro, right?" When they call you again, tell them, "Sorry, I have no idea how to do that, I use Linux." You'll never hear from them again. They'll find someone else with Vista and bug them! The pleasures with Linux laptops are endless.

7 You will love the look on your family members' faces at the holiday party, when Granny figures out how easy it can be to use Linux. Can you imagine everyone gathering around your laptop, as Granny cranks up the sound on *Frozen Bubble*, and everyone starts doing the humpty-hump? Okay, maybe not. But, there's nothing that livens a good family gathering like 16 mugs of eggnog and a Linux game.

6 Good-looking people love Linux system administrators. Paste Linux stickers over the various Microsoft ones and enjoy your Linux laptop at the mall. Passersby will note the air of confidence and energy you present as you type away. Soon enough, extremely gorgeous people will begin to stop and sit down beside you on the bench. You can answer in the affirmative, when they inquire, "Pardon me, is that Linux you're using?" As they smile, recall a few facts. The average Linux system administrator makes more money than law enforcement officers in their tenth year of work or nurse practitioners serving with your local hospital. Job security, money and power attract people like a chocolate sundae served with a cherry on top. Your Linux laptop is the cherry.

5 Installing Linux on a laptop has never been easier. Most flavors now come with the latest drivers, and installation is seamless. Even more important, Linux installation on a laptop averages about 28 minutes for a complete setup. Compare this to the installation of an upgrade of Vista on a Windows XP laptop, which can take more than an hour, and you'll see why Linux on a laptop is not just a good idea, it's a major time-saver!

4 Sleep more peacefully than most, because Linux on your laptop resolves many security-related concerns. For instance, you no longer have to toss and turn in bed worrying about issues like Microsoft Vista's Remote Code Execution Vulnerability, the threat of the GPCoder.h trojan and the JS/Downloader-AUD malware. In fact, most recent viruses and malware utilize vulnerabilities found with Windows, not Linux. Moreover, even if a hack attack on your laptop occurs, you are smart enough to know that using a nonroot login results in an isolated attack. Okay, so not all of these reasons are funny, but they are important. Besides, you may get a good laugh when you hear what happens to people who don't use Linux.

3 Stop annoying friends who are always asking to borrow your laptop to do this and that. The next time they ask if they can "just borrow the laptop to do some work", simply switch the mode so that it defaults to the command line. Hand over the laptop and enjoy seeing their faces as they ask, "what the heck happened?" You can retort by saying, "I installed Linux." They will step away from the table, look at you and yell out a number of expletives. As they walk away, never to be heard from again, switch back to KDE with Beryl.

2 See the raw power of Linux running on a laptop. Recently, a friend of mine connected his laptop that contained a mirror image of his company's intranet site. As the computer team was dealing with a total outage of its intranet server, the site kept running with a simple DNS change. The boss asked him what server he was using to run the site temporarily. He simply pointed down to his laptop. Linux adds a real Nitrous Oxide injection to any laptop.

1 Gain friends and supporters from around the world. In fact, Linux is now used in every country of the world. Moreover, people in countries like Andorra, Eritrea and Kyrgyzstan are happy to help with any concerns you have using Linux. Adding Linux on your laptop opens a whole new world of friendships and camaraderie. Most Linux Web sites today have communities from more than 150 countries! So, if for nothing else, install Linux on that laptop to gain access to one of the most supportive communities on earth.

—MARK RAIS

TiddlyWiki

Jeremy Ruston started work on TiddlyWiki in September 2004, and in August 2007, called it "a moderately active and successful open-source project". He's being modest. At the time of this writing (mid-September 2007), Google finds more than 8 million pages that mention TiddlyWiki, with 2,320,000 of those also mentioning Linux.

TiddlyWiki is a breed apart. Variously described as "a reusable nonlinear personal Web notebook", a "one-file wiki", "a wiki-modeled client-side single-page application" and more, none of the labels are as simple as TiddlyWiki itself: a small standalone HTML file that contains all the JavaScript and CSS it needs to do what it does, which is to give you a simple and straightforward way to write and organize linked and tagged text inside a simple client-side file.

Rather than pages, TiddlyWiki uses "tiddlers"—chunks of text you can write, edit, show, hide, tag, shuffle and otherwise manipulate in a variety of ways. Using it reminds me both of blogs and outliners, yet it's different than both because it's nonlinear and non-hierarchical.

Mostly, it's handy. It's a way of writing in any browser, on or off the Web, in a form that easily can be posted, e-mailed or put on a thumbdrive for what the TiddlyWiki folks call "Wiki-on-a-Stick".

"Our scope is intentionally small", Ruston says. "It's unique to client-side development" and ideal for many purposes small and large—"building customizable user experiences", for example.

TiddlyWiki also is permutational, with many versions, variations, plugins, macros and arcane uses. There are even client-side hosting sites for folks who need it. Checking it out could hardly be easier. For that, go to **tiddlywiki.org**.

And, see if you can come up with a one-word name for its breed.

—DOC SEARLS

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Holiday Fun and Gift Guide

Linux aficionados tend to be early adopters, always on the lookout for the next coolest thing. What better time to bring more gadgets into the home than during the holidays, when the credit-card balance is already so high, you'll never notice that extra impulse buy. Here is a quick look at some gadgets that recently caught our attention.

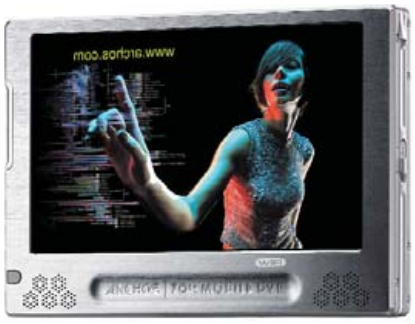
Spykee the Spy Robot (Meccano-Erector)



The countdown is on to November 27, 2007, the day when you can get your very own Spykee the Spy Robot, a clever little robot that includes a Webcam and MP3 player. You can control Spykee from any remote location using the Internet and a local Wi-Fi connection. This vigilant guy can also be your "guard bot". Upon sensing a motion, Spykee activates an alarm or sends a picture of the intruder by e-mail. Spykee also can climb stairs, operate as a Skype VoIP phone and Webcam, stream video to your PC and get itself to its charging station when its battery is low. The product is produced by Meccano-Erector and will be available for around $299 at Amazon.com and Fat Brain Toys.
www.erectorusa.com, **www.amazon.com**, **www.fatbraintoys.com**

Archos 704 Wi-Fi Multimedia Player

Thanks to the French for bringing us such a portable package of Linux fun! The Archos 704 is a multimedia player that, with its 7" display and 80GB hard drive, is big enough to watch yet small enough to bring along wherever. The 704 also has built-in Wi-Fi for Web surfing on the town. Expect at least five hours of video playback, five hours of Web surfing or 16 hours of music. There is also a kit that allows you to capture video and



audio from the field. Most video and audio formats are supported, though some codecs (MPEG-1 and MPEG-2) must be purchased. Suggested retail price is $550, but the street price is closer to $400. Also check out Archos' on-line store for refurbished devices.
www.archos.com

Zypad WL 1000 Wearable Computer (Eurotech Group/Arcom)

The Eurotech Group, developer the Zypad WL 1000, made this wrist-wearable computer for uses like emergency services, law enforcement, defense and the like. We don't care—we want one for Christmas anyway! Able to run Linux kernel 2.6 or Windows CE 5.0, this mobile little ten-ounce gem has all the features of a standard computer and packs touchscreen,



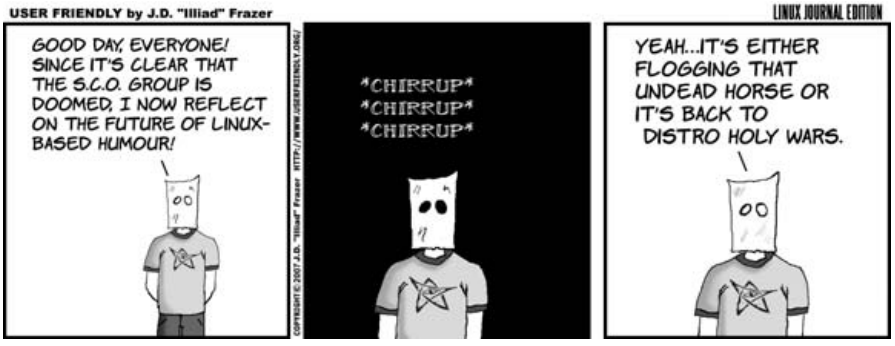
GPS, 802.11b/g Wi-Fi and Bluetooth capabilities. The WL 1000 also has an integrated tilt and dead-reckoning system for remote user tracking and enabling an automatic standby mode when a user's arm hangs next to his or her body. Eurotech says the battery runs up to eight hours due to advanced power management. Other specs include an AU 1100 400MHz processor, 64MB of RAM, 320x240 3.5" TFT display, USB 1.1 device and master ports and an operating range of –10 to +50 degrees Celsius. In order to obtain one, you'll have to order them wholesale; Arcom is Eurotech's affiliate here in the US.
www.arcom.com, **eurotech.com/wearable**

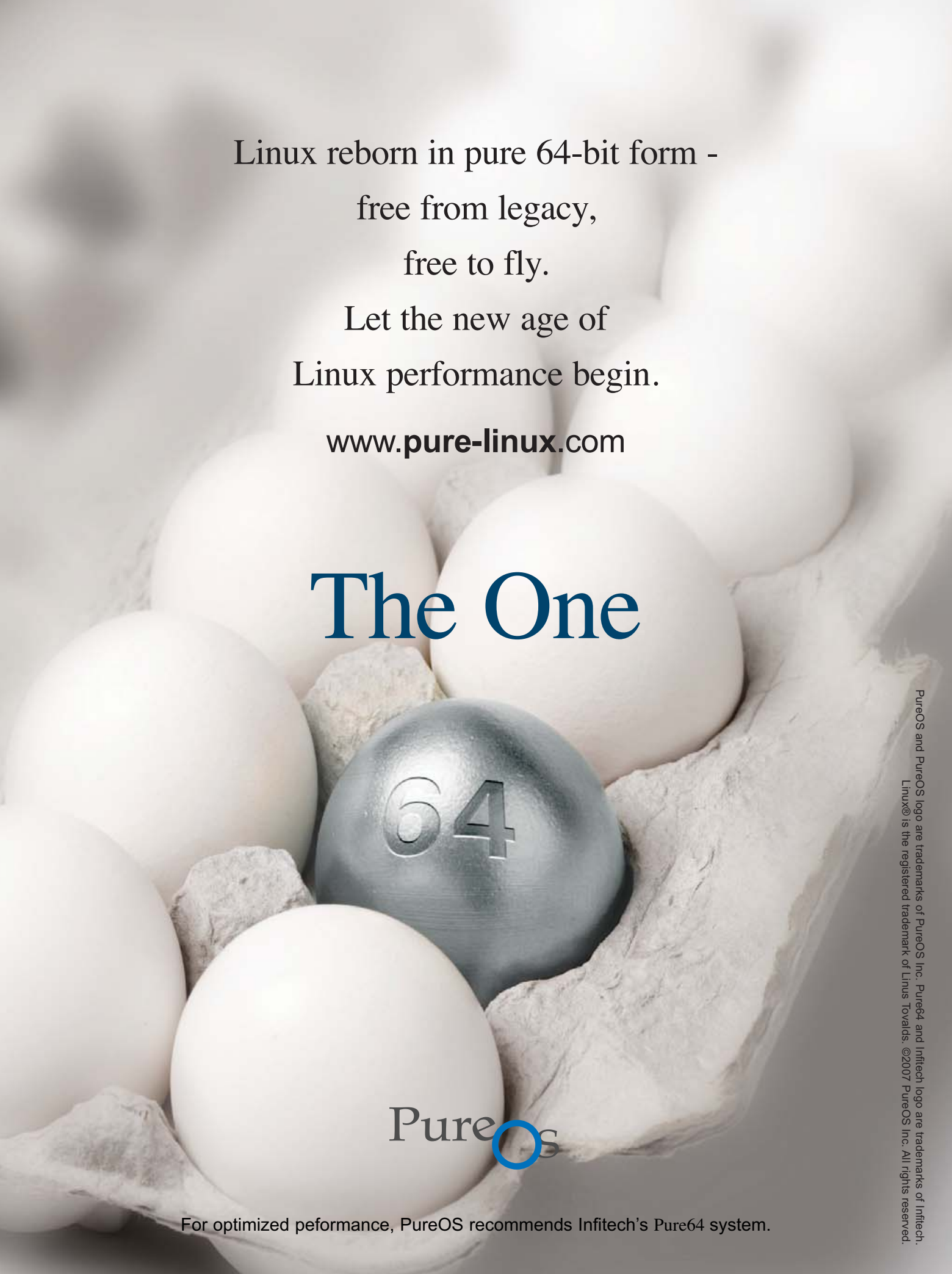
Forerunner 305 (Garmin)



With the right tools, training for next year's Honolulu Marathon will be a mission rather than a chore. Slip on the Garmin Forerunner 305, a cross-country coach for your wrist. The Forerunner is a combination stopwatch, GPS unit, heart monitor, calorie counter, workout planner and pacer, allowing you to monitor and track all of your workout data. The free Garmin Training Center software allows you to chart your progress over time using interactive graphs. Garmin's Forerunner can be purchased for around $320.
www.garmin.com

—JAMES GRAY




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free from legacy,
free to fly.
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Linux performance begin.
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Facebook

Learn how to connect your Web applications to Facebook, the highly popular social-networking suite.

REUVEN M. LERNER

Last month, I described a growing trend in the world of Web/database development. No longer are developers content to create interesting new applications for people to consume. Rather, more and more companies are looking to create service-based platforms, upon which other developers can create new and interesting applications.

For example, many of us think of eBay as a Web site that handles on-line auctions. And it's true; at the end of the day, what pays the bills at eBay is the fact that many people are buying and selling things. But eBay has been especially successful because it offers not a particular application, but rather an infrastructure upon which buyers and sellers can create their own applications. Many of those applications might be invisible to the average user, but they exist nonetheless. There already are many software packages that help vendors price, track and sell their wares, and there are similar packages designed for buyers.

It's pretty easy to differentiate between an application and a platform. The former might have a great deal of functionality, but changes and additions all come from a central group of developers. By contrast, a platform includes software libraries and/or APIs designed to make it easy for developers to expand and modify the core functionality independently. As a platform grows in popularity and developers make use of the API, a small software ecosystem takes root, making it harder to compete with the ecosystem, because so many people have a vested interest in keeping it going.

One of the biggest platform successes of the last few years is Facebook. Facebook originally was meant to be a small, Web-based version of the book that newcomers to Harvard (and MIT, for that matter) are given when they first arrive. Facebook quickly took off, offering a growing amount of functionality, and expanded to students at other universities. Facebook then invited everyone—students and nonstudents alike—to become members. Then, in mid-2007, the Facebook team unveiled F8, the Facebook development platform and API. Now there are tens of thousands of Facebook developers, and although many of them are creating trivial or silly applications, some are creating interesting and profitable ones. Moreover, many people now prefer Facebook to rivals, such as LinkedIn, partly because their friends are on Facebook, but also because there is a large library of Facebook applications they can install and use.

To Web developers, of course, Facebook provides not only a library of applications that we can use, but also an infrastructure on which we can create our own applications. This month, let's dip our toes in the waters of Facebook application development, create our own simple application and see how it can hook into Facebook.

A Souped-Up Proxy

If you have been developing Web applications for a while, you might wonder how it is that Facebook allows people to add their own code to a running Web site. Do you upload your code to a virtual server? Do you run it through a Web service? Do you write it using a macro language within the Facebook system?

The answer turns out to be simpler than any of these possibilities. You run your Web application on your own server, write it in whatever programming language you choose and include whatever functionality you want. When someone invokes your application via Facebook, the Facebook server then makes a request to your Web application. The output from your application is passed along to Facebook, which then integrates it into the page and finally sends the output to the user's browser. In other words, you can think of Facebook as a proxy HTTP server, one that you can configure to allow people to visit your site.

But, of course, things are a bit more complicated than that. When it is invoked by a user, your Web application has access to information about that user and about that user's Facebook friends and networks. Thus, it's possible that Facebook will invoke your application on behalf of a user—and that before it returns any output, your application will send a number of queries to Facebook to learn more about the current user. This back and forth is surprisingly fast, at least on the Facebook end, but it does mean you need to think about what information you really want to request from Facebook, if you want to ensure that your application runs at top speed.

Setting Things Up

The first step in creating a Facebook application is to add the Developer application by going to **facebook.com/developers**. (When you create your own application, people then will have to add it in a similar way.)

You will be asked if you want to add the Developer application. Every application on Facebook has a unique name; I suspect that over time, people will hoard application names, just as they have done with domain names. Notice that you need to agree to add an application explicitly, and that Facebook provides you with a number of options to protect your privacy. So, you can allow (or forbid) the application to access information about you, to put a link in your navigation list or even to publish stories in the "feed" on your home page. This last item is particularly important; when checked, it allows applications to write to your personal feed, which then is picked up and displayed on your friends' home pages.

Once you have added the Developer application, you now can create your own applications. Note that only those Facebook users who want to create new applications need to add the Developer application; if you only want to use applications, there isn't really any need for it.

Now, it's time to create a new application. If you have just added Developer, you will be presented with a link asking if you want to create your first application. If you already have added Developer, go to the Developer home page (**facebook.com/developers**) and click on see my apps. In either case, you'll be given a chance to create a new application. Each developer can create almost any number of applications, and it is free of charge—so don't think that you need to skimp on the number of applications you create.

To create an application, click on the link that says "create one", or if you already have an application, click "apply for another key". The simplest possible application has nothing more than a unique name. But, in general, you should fill in a number of the optional fields associated with an application. Thus, although you could create an application by entering its name and checking the "I have read the terms" box, you probably want more. So, click the optional fields link, and enter the following information:

- The support e-mail address should be yours, at least for the time being.
- The "callback URL" should be a URL on your server that is connected to a Web application framework. In our case, we're going to use a development system for Ruby on Rails for our server application. Thus, the callback URL will be http://atf.lerner.co.il:3000/hello/facebook.
- The "canvas page URL" should be where you enter the application's unique name again. I used rmlljatf for mine, because this is my Facebook application for my column (At the Forge) in *Linux Journal*. You will need to choose a different name.

You can ignore a number of the settings, such as whether you should use FBML (the Facebook Markup Language, a superset of HTML) or iframes, and whether you want a Web or desktop application (in this case, we want the former).

We *do* want people to be able to add our application on Facebook. However, we don't want the new application to be displayed in our feed, and we also want to restrict the application to developers who are working on it. So, although we will click the yes check box that allows people to add the application, we also should click the developer mode check box farther down and the private installation check box below that.

When you finish filling out this form, press Submit. If the form contains no errors, you will be told that your application was created successfully. Moreover, your new application now will be on your developer page. Among other things, your application has an API key and a secret. These are 32-character strings that Facebook uses to ensure that your application and the Facebook server are allowed to communicate.

The Web Application

Facebook now is ready to communicate with our Web application—we had better create one! As I mentioned previously, I'm using Ruby on Rails to create a simple Web application that speaks with Facebook.

Expert Included.

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Now, I could do all the hard work myself. I could read the Facebook documentation, learn the APIs and debug things. Or, I could benefit from some amazing work that others have done, and think about my application, rather than communicate with Facebook.

If you are using Ruby on Rails, you can do this by installing a Ruby gem (that is, a prepackaged bundle of code and documentation):

```
gem install rfacebook
```

The rfacebook gem includes everything you need to speak with the Facebook server from an application. But, it doesn't include some of the glue that a Rails application needs. For that, you need to install a Rails plugin. So first, let's create our Rails application, specifying PostgreSQL as our database:

```
rails -d postgresql rmlljatf
```

After Rails creates all the files it needs, we now can install the rfacebook_on_rails plugin:

```
cd rmlljatf
script/plugin install
svn://rubyforge.org/var/svn/rfacebook/plugins/rfacebook_on_rails
```

Note that in order for this to work, you need to have a Subversion client (svn-client) installed. You also will discover, as I did, that if you don't have the Ruby SSL libraries installed, RFacebook will fail mysteriously. On an Ubuntu machine, such as I'm running, I installed that by typing:

```
apt-get install libopenssl-ruby
```

With all these things in place, we now can use the plugin to configure Facebook for our system:

```
rake facebook:setup
```

Among other things, this creates a configuration file for our Facebook application in config/facebook.yml. As a very explicit note indicates during the execution of rake facebook:setup, we need to open and edit this file in order for things to work. When you open it, you'll see that you need to enter your API key and secret (from the Facebook Developer page on the Web). Where it says yourAppName next to canvas_path, enter your application name. In my case, it's rmlljatf. And, where it says callback_path, replace it with the URL you expect to use for the Facebook application on your server. In my case, that's just /hello/facebook. (This should be a relative URL.)

Let's create a controller for our application:

```
./script/generate controller hello
```

Then, remove the file public/index.rhtml.

Finally, create a simple method in our hello controller:

```
def index
  render :text => "hello"
end
```

Sure enough, when I point my browser to http://atf.lerner.co.il:3000/hello the controller (hello) is invoked, as is the default action for that controller (index). And, I see "hello" in plain text in my browser. Yay!

Let's write a tiny bit more code to get things ready. First, let's define a new method in our hello controller:

```
def facebook
end
```

Notice that we haven't defined anything in the method, other than that it exists. Next, we create a facebook.rhtml file in app/views/hello:

```
<p>Hello, FacebookWorld!</p>
```

We can see the results at http://atf.lerner.co.il:3000/hello/facebook, which displays:

```
Hello, FacebookWorld!
```

Hello, FacebookWorld

Experienced coders know that looking through log files is a great way to keep track of what is happening. Rails includes a log file for each environment, giving you separate logs for the development and production environments, in case they're installed in the same directory on the same computer.

If I look at the development log (logs/development.log) after my invocation of the index method, I see the following at the bottom:

```
Processing HelloController#index (for 84.110.255.110 at 2007-09-12
08:26:08) [GET]
  Session ID: ef0e25ea44f91f3c900f54c4bca93506
  Parameters: {"action"=>"index", "controller"=>"hello"}
Completed in 0.00339 (295 reqs/sec) | Rendering: 0.00016 (4%) | 200 OK
[http://atf.lerner.co.il/]
```

None of that should surprise us, and it even should make us happy. But, if I look right above that, I see some log file messages that are coming from the RFacebook plugin:

```
** RFACEBOOK INFO: It looks like you don't have memcache-client,
   so MemCacheStore was not extended
** RFACEBOOK INFO: using default Rails sessions (since we didn't
   find an fb_sig_session_key in the environment)
```

It looks like even without explicitly asking for RFacebook to do anything, it already has started to look around and act. The first message has to do with

memcached; although it might be useful for certain distributed applications, we don't need it for right now. The second note indicates that our method was invoked directly, rather than via Facebook, so there wasn't any Facebook session information to retrieve. As a result, we'll use regular Rails sessions, rather than Facebook sessions.

How can we invoke our application via Facebook? The first thing to do is add the application. Go to the developer page (**facebook.com/developers**), and click on the name of the application (rmlljatf). On the right side of the page, there should be a big blue button marked Add application. Click that button, click the similar button on the next page, and the rmlljatf application will be installed.

Now, I can point my browser to http://apps.facebook.com/rmlljatf, and what do I see? Yes, you guessed it—a cute little message, saying:

```
Hello, FacebookWorld!
```

We managed to point our browser to Facebook, which invoked the application on our server, which returned results that were then displayed inside of the Facebook page. Not bad, right?

Summary

This month, we saw how we can basically connect a Web application on our server with Facebook, displaying the output inside a Facebook page. Next month, we'll look at how our Web application can access information from Facebook, interacting with the Facebook database in a number of different ways.■

Reuven M. Lerner, a longtime Web/database developer and consultant, is a PhD candidate in learning sciences at Northwestern University, studying on-line learning communities. He recently returned (with his wife and three children) to their home in Modi'in, Israel, after four years in the Chicago area.

Resources

Facebook: **www.facebook.com**

Facebook Developer Documentation: **developers.facebook.com/documentation.php?v=1.0**

rfacebook: **rfacebook.rubyforge.org**





Exciting Arcade Action in Glorious ASCII

MARCEL GAGNÉ

Who says you need a fancy high-end graphics card to play some great Linux games? Heck, who says you need graphics at all?

Three frames per minute? Yes, François, I would call that pretty bad performance. While I admire your desire to reuse old hardware to build your Linux desktop, I have to say that your new system might be a little underpowered for running *FlightGear*. Of course, *mon ami*, it is a great game, but you need a more powerful system and an accelerated 3-D graphics card. Now, don't look so sad, François. Our guests will be here shortly, and tonight's menu features some great games that you can run on the most basic of systems. *Non*, you must wait until our guests arrive.

Mon Dieu! They are approaching as we speak. Prepare yourself, François. Welcome, everyone, to *Chez Marcel*, home of fine wines and excellent Linux and open-source software. Our wine cellar, as you know, is one of the world's finest, and yet, even our selection pales in comparison to the number of great open-source projects. Luckily, there is a wine for all packages. Please sit, *mes amis*, while François makes his way to the wine cellar. Please, François, bring back the 2002 Chassagne-Montrachet "Champ Gains". While we wait for the wine, let's talk about great gaming action with minimal resources.

Playing fast-paced arcade games doesn't necessarily require high-end hardware. In fact, you can find games that don't require a graphics card at all. I know what you are thinking. Chef Marcel has been sampling a little more wine than usual today. Although that may be true (a little joke, *non*?), it hasn't clouded my judgment. The items on tonight's menu are all text- or ncurses-based games, and all you need to play them is your Linux system and an open terminal window. Now, you aren't likely to find most of these packages in your favorite distribution's repository, but never fear. Given the simplicity of these packages, you'll find they pretty much compile without fuss and without the need for a lot of extra libraries—just use the extract-and-build five-step.

Way back when your humble Chef spent his hard-earned quarters at the video arcade, he particularly enjoyed defending Earth from invading aliens. The year was 1978, and the game was *Space Invaders*. Even today, *Space Invaders* is still a hugely popular game. I actually ran across two versions of the old *Space Invaders* game—one somewhat more text-heavy than the other. The first is Thomas Munro's *ASCII Invaders* (Figure 1). This one is definitely the textiest (is there such a word?), and it's very true to the spirit of the original game. Visit his site at **www.ip9.org/munro/invaders/index.html**.

My guess is that I don't have to tell you how to play this

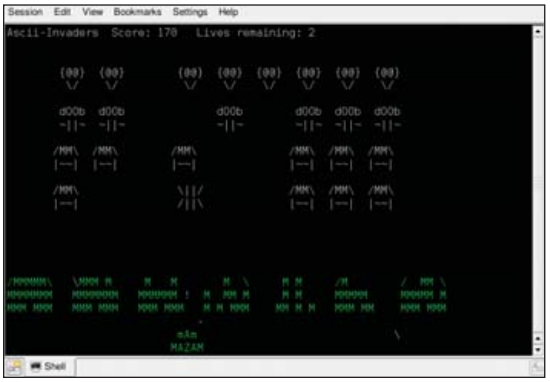


Figure 1. All the Action of the Original *Space Invaders* in Glorious ASCII

game. There's a gun platform at the bottom of the screen that you move left and right with cursor keys. Press the spacebar to fire and try to get all the aliens before they come down and blow you away. Occasionally, flying saucers will sail overhead. These are worth more, so make sure you get those when you can. It's easy to play, but hard to win. Keep moving and stay alive long enough to fight the next wave.

Before we move on to the next text-based game, let's look at yet another *Space Invaders* clone, mostly because it's handled a little differently to provide alternative graphics. This one is called *nInvaders* (Figure 2), and it comes to us from Thomas Dettbarn and friends over at **ninvaders.sourceforge.net**.



Figure 2. *nInvaders* is a somewhat more colorful *Space Invaders* clone.

Do you remember a game called *Boulder Dash* and its hero, Rockford? The premise of the game involved a prospector searching for diamonds and other gems underground (another, similar game available for your Linux system is *Rocks & Diamonds*). To get to the gems, our hero needed to dig his way through the ground, avoiding falling rocks and cave-ins, both of which spelled certain doom. Tom Rune Flo's very cool *Cavez of Phear* (Figure 3) is available from **www.x86.no/cavezofphear**.



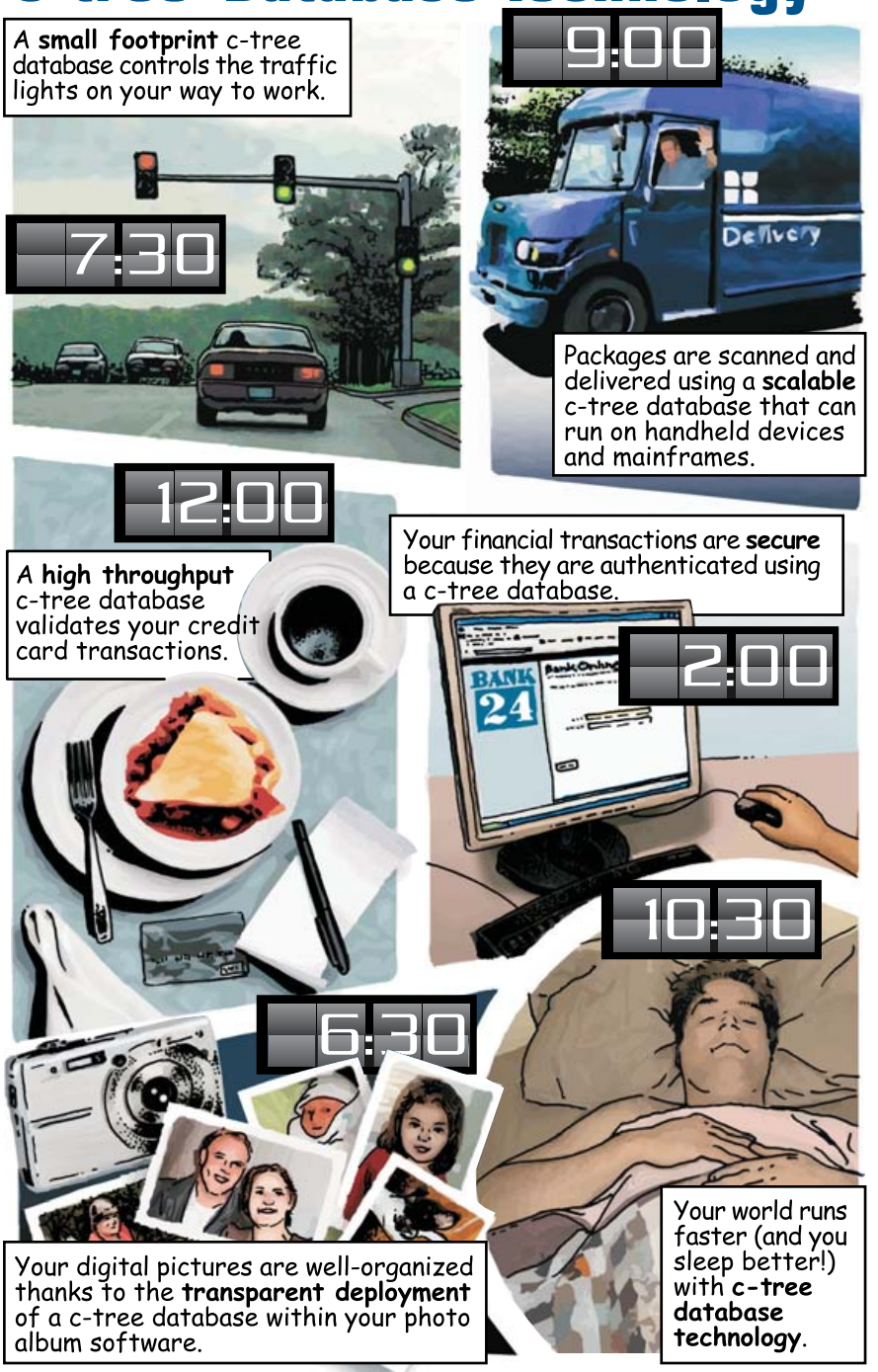
Figure 3. Enter the *Cavez of Phear* where Death awaits...what's with all this Death?

To start the game, run the program, `phear`. An ASCII underground cave system will be created for you, complete with diamonds located in hard-to-reach places with boulders ready to cave in on your Z-head if you aren't careful. The game screen tracks your score, lives and, most important, the number of diamonds you need to collect in order to advance to the next screen (Figure 4).

Cursor keys let you navigate through the caves. If you get totally trapped in a cave, which can happen with a cave-in, pressing the K key provides you with an easy way to commit suicide (your ASCII self, not you). Collect bombs (which appear as % symbols), pressing B to place them and T to detonate them. Bombs, as I'm sure you know, can help you get out of otherwise impossible situations. Oh yes, there also are the monsters (shown as letter Ms). Whatever you do, don't let the monsters touch you, because they will kill you. Did I mention that *Cavez of Phear* even has sound? Simply press S to toggle sound on and off.

The final item on tonight's menu is a bit of an overkill when it comes to ASCII games. Featuring client/server network play, complex, fast-paced 16-color animation, multiple weapons, exploding characters and gushing blood, the aptly named *Overkill* takes ASCII games to their sane limit. Written by Karel Kulhavy, Petr Kulhavy and others, *Overkill* promises that "you'll learn what

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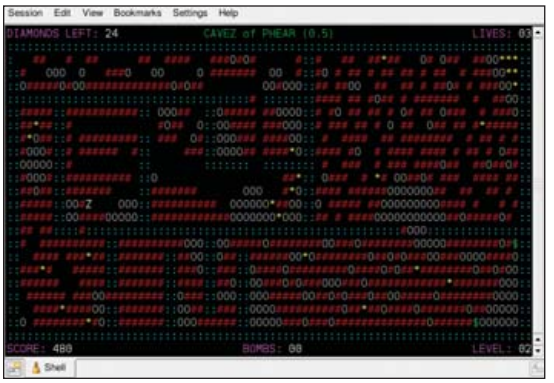


Figure 4. *Cavez of Phear* awaits you. Collect the diamonds and watch your head.

a horror man can see in ASCII". You'll find *Overkill* at **artax.karlin.mff.cuni.cz/~brain/0verkill**. Of the games mentioned here, *Overkill* is the one game you might find in your distribution's repositories. If you are using Ubuntu Linux, for instance, you can install it with apt or Synaptic. The site also provides binaries, if you don't want to compile the program.

Because this is a client/server game, you need to start by running the `server` program. In the packaged version, the program is actually called `overkill-server`. Now, open up another terminal window and run the client, a program called `0verkill` (`overkill` in the package). The startup screen scrolls some interesting statements at the bottom and gives you a hint of what you can expect (Figure 5).

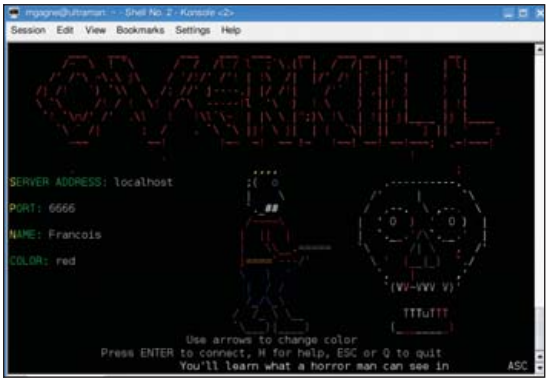


Figure 5. *Overkill*—think of it as *Doom* meets ASCII.

All you need now to start the game is to connect to a running server, press S, then enter the hostname or IP address. *Overkill* comes with both male and female characters. Those characters, in turn, can be customized by giving them a unique color scheme. To change the color, press the up or down arrow while at the connect screen. To change from male to female, cycle through the 16 colors. Once you have selected a character, press the N key to give it a name.

Everything is controlled via keystrokes. Press the left and right arrow keys to move left and right. Press the up key to jump or climb. As you work your way through the various levels, you'll collect weapons and ammunition; to use a different weapon, press the 1, 2, 3, 4 or 5 keys. If and when you get killed, an event that occurs in truly gruesome, blood-curdling ASCII, you can respawn your character by pressing the space-bar. If you get stuck, press H for a handy help menu. You can still have fun playing on your own, but to get your heart really pumping, invite a friend (or two or three) to connect for great multiplayer action (Figure 6). The game even remembers what has come before, as you'll notice when the corpses start to pile up (shudder). It's great, heart-thumping and fast network fun.



Figure 6. You have no friends here. It's kill or be killed in a game of *Overkill*.

Speaking of fast, is it possible that time has gone by so quickly? *Mon Dieu!* It is nearly closing time. Perhaps we can convince François to refill your glasses a final time, which will give you just enough time for another ASCII deathmatch, with or without aliens, before you go. Raise your glasses, *mes amis*, and let us all drink to one another's health. *A votre santé! Bon appétit!*■

Marcel Gagné is an award-winning writer living in Waterloo, Ontario. He is the author of the all-new *Moving to Free Software*, his sixth book from Addison-Wesley. He also makes regular television appearances as Call for Help's Linux guy. Marcel is also a pilot, a past Top-40 disc jockey, writes science fiction and fantasy, and folds a mean Origami T-Rex. He can be reached via e-mail at mggagne@salmar.com. You can discover lots of other things (including great Wine links) from his Web site at www.marcelgagne.com.

Resources

ASCII Invaders: **www.ip9.org/munro/invaders**

Cavez of Phear: **www.x86.no/cavezofphear**

nInvaders: **ninvaders.sourceforge.net**

Overkill: **artax.karlin.mff.cuni.cz/~brain/0verkill**

Marcel's Web Site: **www.marcelgagne.com**

The WFTL-LUG, Marcel's Online Linux User Group: **www.marcelgagne.com/wftllugform.html**

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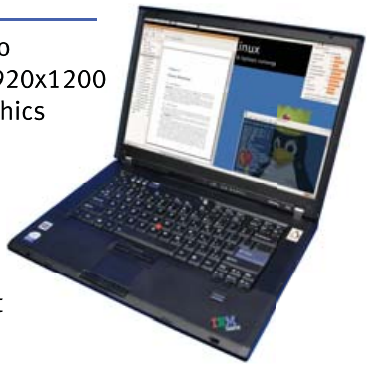
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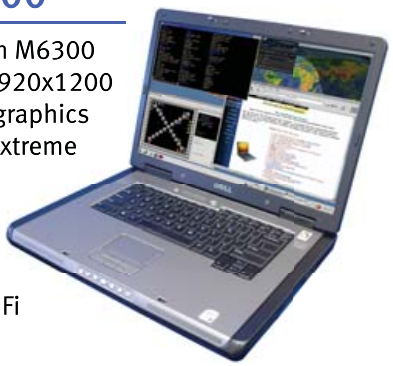


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DAVE TAYLOR

Solve: a Command-Line Calculator

Use bc as a quick-and-dirty command-line utility.

One thing that's always bothered me about Linux, and UNIX before it, is that there isn't a decent command-line calculator available. You know, something where you can type in `solve 5+8` or, better, `solve 33/5` and get the solution.

There's expr, but that's barely useful at all, and I've always been baffled that it's constrained to integer math to this day. No one has ever extended its functionality beyond the most rudimentary capabilities for shell script programming.

There's bc, which has the power we seek, but it has to be one of the most bizarre interfaces of any program in the Linux panoply, and there's nothing more frustrating than accidentally falling into bc and being unable to get out!

The third choice is dc, the so-called desktop calculator (really, that's what dc stands for), but that too is fundamentally flawed because it uses RPN (reverse Polish notation—really, it's named after Polish mathematician Jan Lukasiewicz). Not sure what that is? Well, here's a demonstration of how it doesn't work:

```
$ dc 1+1
Could not open file 1+1: No such file or directory
$ dc -e 1+1
dc: stack empty
$ dc -e 1 + 1
Could not open file +: No such file or directory
```

With this kind of burnout on a rudimentary math task, do you really care about learning an entirely new notation to figure out that 1+1=3? No, 2?

Of these three choices, none suffice, but bc does show promise because it can handle floating-point numbers and has the ability to specify how much post-decimal-point precision you seek. Learn its obscure notation, and you can calculate 1+1:

```
$ bc
bc 1.06
Copyright 1991-1994, 1997, 1998, 2000 Free Software Foundation, Inc.
This is free software with ABSOLUTELY NO WARRANTY.
For details type `warranty'.
1+1
2
quit
$
```

The challenge with bc is to revamp how you interact with it—to put a wrapper program "in front" of the utility so that you can use it as a quick-and-dirty command-line utility.

There are two problems with using it that way as designed, as you can see here:

```
$ bc 1+1
File 1+1 is unavailable.
```

and here:

```
$ bc -q
3/2
1
quit
$
```

(The -q option gets rid of the FSF intro header.)

By default, bc offers up integer results only, so although you and I know that 3/2 = 1.5, bc shows it as 1, which makes it pretty darn useless for any precision calculations.

However, unlike the other calculation alternatives, bc does have the ability to be a bit more precise. The key is that you have to specify the scale, the number of digits after the decimal point that you want to see. Add that, and things change:

```
$ bc -q
11/7
1
scale=8
11/7
1.57142857
quit
$
```

The challenge for us is to figure out a way to write a shell script wrapper that allows us not only to do simple calculations from the command line, but also have them solved as floating-point calculations. The goal is to be able to type something like `solve 11/7`, and have it display 1.57142857.

Of Wrappers and Rappers

At this point, given my headline, I have an urge to write in some sort of rhyming slang, but I know my editor won't

let me get away with it, so you're safe. Nonetheless, wrappers are an important concept and a big part of why Linux is so darn powerful as an operating system.

In many ways, UNIX and Linux supply all the tools you need, the rudimentary building blocks, and one of the purposes of shell script programming is to add the veneer, the pleasantry of a usable user interface. That's exactly what we're doing with our solve script if you think about it. Actually, doing mathematics in a shell script would be pretty tricky, but we certainly can transform a simple query into the more complicated sequence of commands needed to get bc to output what we desire.

The challenge though is that we're not simply adding a command flag or turning an express around; we need to capture the requested formula and inject it into a sequence of commands that we're feeding the underlying Linux utility via standard input (stdin).

I do this by using what's called a here document, as denoted with the notation << in a script. Recall that a notation like `wc < letter.txt` invokes the wc command and uses the contents of letter.txt as stdin for the command. The result is the number of characters, words and lines in the file, as if I'd actually typed in the file, letter by letter.

The << notation is a convenient way to have a similar remapping of standard input for the invoked command, but based on the material that's actually present in the command sequence, not a separate file.

As a result, the character sequence immediately following the << symbol is the end marker, not the filename. It works like this:

```
cat << EndOfInput
This is a sample of the kind of
trick you can do with a here document.
Why is this cool?  Because you can also
expand variables ($PATH)
and do other spiffo shell script
hijinks.
EndOfInput
```

Run this little script snippet (as a script), and you'll see the following:

```
$ sh samplepscript.sh
This is a sample of the kind of
trick you can do with a here document.
Why is this cool?  Because you can also
expand variables (/bin:/sbin:/usr/bin:/usr/sbin)
and do other spiffo shell script
hijinks.
```

In our case, this also means you can move a command-line argument into the middle of a sequence of commands being sent to a core Linux command like bc. For example:

```
#!/bin/sh

bc << EOF
scale=4
$@
quit
EOF
```

With this kind of burnout on a rudimentary math task, do you really care about learning an entirely new notation to figure out that 1+1=3?

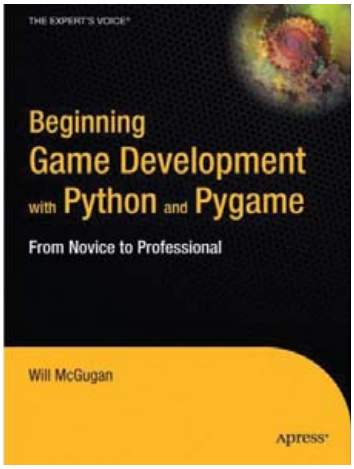
Believe it or not, that's the rudimentary solution to our challenge of writing a floating-point-capable command-line calculator. Check it out:

```
$ sh solve.sh 1+1
2
$ sh solve.sh 11/7
1.5714
```

Next month, we'll dig into useful refinements and make it a full-blown addition to our Linux toolkit. See you then!■

Dave Taylor is a 26-year veteran of UNIX, creator of The Elm Mail System, and most recently author of both the best-selling *Wicked Cool Shell Scripts* and *Teach Yourself Unix in 24 Hours*, among his 16 technical books. His main Web site is at www.intuitive.com, and he also offers up tech support at AskDaveTaylor.com.





Beginning Game Development with Python and Pygame: From Novice to Professional by Will McGugan (Apress)

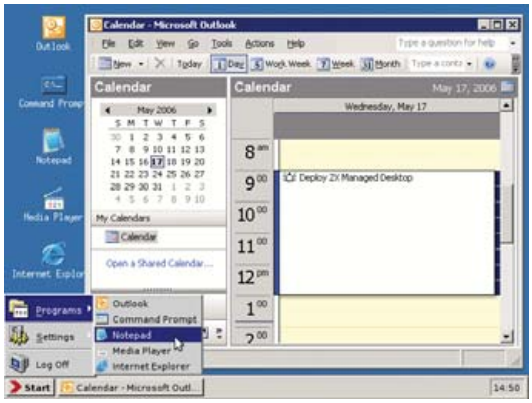
Our poor monthly book selections were bumped last month by the LinuxWorld announcement binge, so let's get back to it. Apress has a fun new book out: *Beginning Game Development with Python and Pygame: From Novice to Professional* by Will McGugan. The idea is to train the budding game developer (but not Python expert) as both a game creator and proficient user of Python and the Pygame games development library. In creating your own tank warfare game, you learn how to deal with gaming preferences, sound, visual effects, keyboard/joystick interactions, multiple platform issues and so on.

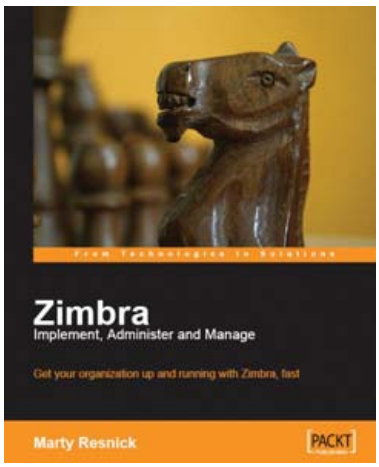
www.apress.com

2X's ThinClientServer

The company 2X is touting its new ThinClientServer 5 as not just a secure and cost-efficient solution but an environmentally friendly one as well. 2X claims that the thin-client model utilizes up to 50% less electricity than its fatter counterpart. ThinClientServer 5 deploys a small-footprint, always-up-to-date, Linux-based OS to popular thin-client devices. Some of Version 5's new features include full redundancy of configuration and settings, load balancing and high availability for PXE booting, ThinClientOS USB disk boot and installer, and Jetdirect print-server support. A free trial version is available on 2X's Web site.

www.2x.com/thinclientserver





Zimbra: Implement, Administer and Manage by Marty Resnick (Packt Publishing)

The nifty Zimbra messaging and collaboration suite now has the honor of its own book, namely Packt Publishing's *Zimbra: Implement, Administer and Manage* by Marty Resnick. The book shows how to install and configure the multiplatform and open-source Zimbra server for use with Zimbra's Ajax Web client, Outlook and mobile devices. Some of the topics covered include application architecture, administration, security and Zimlets—the mashups that make Zimbra so unique and cool.

www.packtpub.com

Attensa's Feed Server Virtual Appliance



Making RSS a snap is the idea behind the new Feed Server Virtual Appliance from Attensa. Essentially, Attensa has merged its existing Feed Server—an application for complete management of enterprise-wide RSS coordination—with the rPath Linux-based virtual appliance platform. The virtual appliance format, says Attensa, simplifies the hassles of installation, integration, maintenance and administration. A free trial version of the Feed Server is available at Attensa's Web site.

www.attensa.com

Anawiki Games' *Path of Magic*

It always has been tough for small games publishers from outside the US to make their mark on our shores. Shipping boxes of air for mafia-controlled shelf space at CompUSA is no way to make a living. Thanks to the Internet, you can download cool (and Linux-based) games from publishers like Poland's Anawiki Games. Anawiki's new adventure is *Path of Magic*, sequel to its previous *Runes of Magic*. Playable without its predecessor, *Path of Magic* is a puzzle-driven game with more than 51 challenging levels, six image puzzles and two bonus games. The main character Evelyne continues her quest through Avalon and must find her way home on the "Path of Magic". 3-D-accelerated OpenGL is required.

www.anawiki.com



MontaVista's Mobilinux

MontaVista has high hopes for its new Mobilinux 5.0, a mobile operating system used in a large number of Linux-based smartphones. The company says that Version 5.0, with its sophisticated development environment, will allow manufacturers to create new mobile devices (such as, phone handsets, GPS devices and wireless POS terminals) to consumers more quickly. Key highlights of this upgrade include NSA-level mobile security using MicroSELinux, dynamic power management, built-in connectivity (SDIO, Wi-Fi and so on), integrated real-time response, quick startup (less than seconds), smaller footprint, and support for multicore processors and the Linux 2.6.21 kernel. The first platforms supported will be Texas Instruments' OMAP 2430 and 3430, followed by six additional platforms in early 2008.

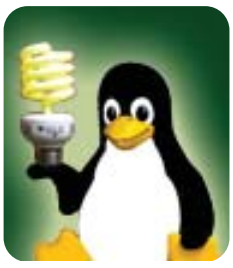
www.mvista.com

Arcom's TITAN PC/104 PXA270 Single-Board Computer

Arcom's new arrival is its TITAN PC/104 PXA270 single-board computer. TITAN is based on the Intel 520MHz PXA270 XScale RISC processor and is targeted at ultra-low-power, fanless embedded systems. Typical consumption is merely 1.5W, and additional dynamically adjusted sleep modes to reduce its power needs further are supported. The TITAN has ready-to-run development kits for embedded Linux and Microsoft Windows CE 5.0, each containing the requisite documentation and tools for immediate deployment.

www.arcom.com





Intel's LessWatts.org

LessWatts.org is a new green project plus Web site from the Open Source Technology Center at Intel. The mission is to create "a community around saving power on Linux by bringing developers, users and sysadmins together to share software, optimizations, tips and tricks". The site covers mobile devices, desktops and servers and uses both software and hardware solutions to reduce power consumption. One example of available solutions is PowerTOP, a tool for assessing how well a system is doing at saving power and which components are "misbehaving" while the computer is idle.

www.lesswatts.org

Please send information about releases of Linux-related products to James Gray at newproducts@linuxjournal.com or New Products c/o *Linux Journal*, 1752 NW Market Street, #200, Seattle, WA 98107. Submissions are edited for length and content.



The State of the Market:

A LAPTOP BUYING GUIDE



A wide variety of vendors—now including Dell and Lenovo—sell preloaded Linux laptops. This buying guide should help you find the right laptop for your needs and budget.

JAMES GRAY

Although installing Linux on desktop PCs with standard hardware has become a snap, the same cannot be said as confidently for laptops. Getting all of a laptop's functionality to work on your own generally requires an investment of time and effort, which may not yield dividends in the end. If you need a Linux laptop that lets you open the box and get to work, we recommend the purchase of a preloaded machine from one of the many excellent vendors in today's marketplace.

When you begin your search for the perfect preloaded Linux laptop, you'll quickly learn the hard truth that we in the faithful Linux nation have fewer cutting-edge laptops than our Windows-running counterparts. Nevertheless, there is much to celebrate as life gradually becomes more fair for us. Innovation and new options are plentiful among both our old standby Linux hardware vendors and new, larger providers, such as Lenovo and Dell. Although we Linuxers most likely can't make every laptop out there run Linux, we have a wide selection from every category, with more variety arriving every day.

In addition to commending the ongoing efforts of the Linux hardware specialists, we warmly welcome Dell and Lenovo to the club of Linux laptop providers, happy the big vendors finally see the light. Unfortunately, both companies have started small and conservatively at one laptop apiece, each with fewer features than the exact same model with Windows Vista preloaded. Regardless, we wish these firms success and encourage them to let buyers purchase every PC they sell with Linux preloaded. We also hope this new competition will spur longtime Linux vendors to push themselves to offer even more variety and options at lower prices.

What's Out There?

If you venture into the vast on-line PC marketplace, you'll find nearly a dozen US and Canadian firms (many more elsewhere, of course) peddling a wide range of laptop computers with Linux preloaded. Most of these firms are Linux specialists that load Linux onto and configure a third-party machine. In these firms' on-line stores, you'll have absolutely no problem finding a great selection of powerful, practical, business-oriented laptops with a 14.1", 15.4" or 17" display, a robust Core 2 Duo processor, buckets of RAM and a mammoth hard drive that cost less than $2,000. Almost without exception, you can configure your laptop as either a Linux-only or a dual-boot machine, with some vendors offering only Windows XP and others offering a choice between Windows XP or Vista. Unfortunately, the generalists, Lenovo and Dell, have decided to forgo the dual-boot option for now, which we predict will reduce their sales—we Linux folks demand a high degree of choice and control.

Specialty machines are harder to find in the Linux space, as are functioning specialty features on many of the available machines. Regarding specialty machines running Linux, if you want a screaming gaming machine, a media center or an ultraportable, your options are much more limited. In addition, when you're buying one of the available Linux machines, be a wary buyer because oftentimes a laptop will ship with, for example, a built-in Webcam, fingerprint scanner, cellular broadband capability or 802.11n Wi-Fi, but the vendor hasn't gotten it to work yet under Linux.

Despite the above complaints, you can find a limited number of interesting specialty laptops if you know where to look. One company to watch is Taiwan's ASUS, manufacturer of the most common laptops onto which the Linux specialists (such as R Cubed, LinuxCertified and HPC Systems) choose to preload Linux. The must-have device at the close of 2007 is the new ASUS Eee PC, a brand-new two-pound ultraportable with a 7" display that will sell for $259 and up. See below for more details.

If you have a quirky laptop need, perhaps the best place to look is at EmperorLinux, a company specializing in Linux-based laptops from a number of manufacturers, including Dell, Lenovo, Panasonic and Sony. Not only does EmperorLinux attempt to cover nearly every niche, including ultraportable, rugged, tablet and desktop replacements, but it also does the best job of making advanced features, such as GPS, cellular broadband, tablets and 802.11n Wi-Fi, work out of the box. See below for reviews of two laptops from EmperorLinux.

It also is heartening to know we have more options for protecting the environment when choosing a Linux laptop, as many of them are Energy Star-compliant. This means the device meets or exceeds criteria from the Environmental Protection Agency for energy consumption. Among other things, Energy Star-compliant notebooks must consume no more than 1W of power when off, 1.7W when hibernating and 22W when idle.

So that's the big picture; now, let's find a laptop that meets your needs. To give you a sense of what preloaded Linux laptops are available, we've created this laptop buyer's guide. We asked all the vendors we could find to send us their two most compelling machines for review. Although not every company took part, the ones below did. This guide is not intended to be exhaustive but rather a taste test of some currently available preloaded Linux laptops.

Below are mini reviews of seven different preloaded Linux laptops (eight if you include the ASUS Z84J sent by two different vendors) that you can buy today. The primary emphasis of these reviews is on the overall Linux experience and functionality, which surprisingly varies greatly among vendors. The secondary emphasis is on the feature sets. All machines, unless otherwise noted, came with integrated 802.11a/b/g Wi-Fi and Bluetooth, which are standard features nowadays.

EmperorLinux Rhino D830 (Dell Latitude D830)—Power and Graphics in a Portable Package

The Rhino D830, the Linux edition of the Dell Latitude D830, is a desktop replacement machine for those who want a mid-sized presence (15.4" WUXGA display at 1920x1200) with a blend of solid features and excellent performance at a decent price. Weighing in at just more than seven pounds, the Rhino D830 may become annoyingly heavy in transit. Nevertheless, the machine has a sturdy, sleek and durable magnesium alloy frame, responsive keyboard and long-lasting 9-cell battery.

Our test Rhino D830 came with a 2.2GHz Intel Core 2 Duo processor, 2GB of RAM, 160GB hard drive (7,200rpm), DVD+/-RW drive (Blu-ray optional), the NVIDIA Quadro NVS 140M1 video card with 256MB of video RAM and accelerated OpenGL for workstation-level graphics applications, such as video editing and 3-D



EmperorLinux Rhino D830

modeling. You can order the Rhino D830 with up to 8GB of RAM.

In our experience, EmperorLinux is hands-down the most fanatical vendor regarding attention to detail and making sure every feature works well under Linux. EmperorLinux also provides the most complete documentation. The Rhino D830 we tested ran 64-bit Fedora 7 with EmperorLinux's own custom kernel, as well as Windows XP Home. As expected, nearly everything worked as promised, including the Fn keys and fingerprint scanner. Furthermore, EmperorLinux has ensured that the optional Verizon EV-DO cellular data modem works, although it must be activated one time under Windows. This is the only laptop we tested with this functionality working. Finally, EmperorLinux says it is vigilantly improving the 802.11n Wi-Fi on this machine as it begins to ship the IPW4965 wireless Ethernet cards and the state of the driver improves.

Pros:

- The best documentation in the business.
- Decent built-in speakers.
- External "Wi-Fi Catcher" switch, indicating signal locator and on/off switch (not mentioned in the documentation).
- Optional encrypted /home partition.
- Has both pointing stick and touchpad.
- Energy Star-compliant.

Cons:

- Be prepared for the weight.
- It would be great if EmperorLinux could run the same promotional pricing as Dell. Otherwise, prices are comparable.

Support/warranty: one year of free, unlimited phone and e-mail support from EmperorLinux and three years of hardware warranty from Dell included.

Price as tested: $2,250.

Lenovo IBM ThinkPad T61—Ergonomic Business Machine

Although you already can purchase the Lenovo IBM ThinkPad T61 from EmperorLinux under its Toucan line, it's refreshing to see Lenovo developing preloaded Linux laptops as well. For this article, we were able to acquire a preview machine that should be available to the general public before Christmas 2007. To its credit, Lenovo has retained the original ThinkPad ergonomic quality in the T61. We liked the intelligent keyboard layout, the keyboard response and the presence of both a pointing stick and touchpad for navigating this machine. Furthermore, although we don't much appreciate that the battery juts out the back and that the casing is the same old plastic (and not a lighter alloy), the classic ThinkPad aura is easy to like. At 5.2 pounds, this machine would work for a road warrior seeking portable power.

Our review ThinkPad T61 ran SUSE Linux Enterprise Desktop (SLED) and had a 14.1" WXGA+ (at 1440x900) display, an Intel Centrino Core 2 Duo T7700 at 2.40GHz, 2GB of RAM, 160GB hard drive, DVD+/-RW drive and an NVIDIA Quadro NVS 140M video card with 128MB of video RAM.



Lenovo IBM ThinkPad T61 »

We caught Lenovo in product-development mode when reviewing the T61, which was evident in the hobbled state of its Linux-based functionality. Therefore, it is unfair to complain about the many things that aren't working just yet. My contact at Lenovo, despite his Tony Snow-worthy evasions, has assured me that its engineers are working quickly and furiously to provide full support for SUSE Linux Enterprise Desktop. Some issues in development include full support for the NVIDIA video card (for 3-D acceleration and Xgl/Compiz) and power management (suspend to disk and suspend to RAM). The machine we received had a fingerprint reader, which unfortunately will not be present on the Linux-based production machine.

Politics aside for a moment, it was a smart choice aesthetically and functionally for Lenovo to go with SLED. Not only is SLED an excellent, well-planned distribution with an attractive menu system and the sexy Xgl graphical environment, it offers useful applications, such as Novell AppArmor. At the time of this writing, Lenovo was unsure whether it will offer dual-boot or Linux-only machines.

Although we cannot yet fully judge whether Lenovo has scored a touchdown with the ThinkPad T61, it is clear that the company is trying hard, in cooperation with Novell/SUSE, to offer a top-quality Linux laptop with a competitive (and functional) feature set. We encourage Lenovo to continue its efforts over the long term and not just give Linux a halfhearted try, only to prophesy Linux's lack of viability.

Pros:

- The most ergonomically pleasing machine of those tested.
- Useful reading light.
- Has both pointing stick and touchpad.

Cons:

- EV-DO and 802.11n capability will not likely run under Linux.
- The Windows Vista sticker hasn't been removed yet.
- Wimpy 56 WH battery.

Support: TBA.

Price as tested: TBA.

EmperorLinux Wasp CF-19 (Panasonic Toughbook CF-19)—Battle-Ready Rugged Notebook

Because your company likely will be ponying up the $4,250 for this notebook, you should read on. The Wasp CF-19 is EmperorLinux's Linux-based iteration of the Panasonic Toughbook CF-19. Indeed, this tough cookie is no ordinary laptop. Built like an M1 Abrams tank (and used by the US military), the rugged Wasp CF-19 was a joy to review because we got to see how much thought

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and effort the Panasonic engineers put into creatively armoring a computer's exterior. The Wasp CF-19 is the kind of laptop to accompany you on the construction site, surveying job, research expedition or field maneuver. It has been tested independently as MIL-STD-810F (US military standard) compliant, meaning it can withstand punishment, such as a fall of one meter, 15,000 feet of altitude and an operating temperature range of –20 to 140 degrees Fahrenheit. Other tests include vibration, dust, humidity, water resistance, thermal shock and so forth.

Given its rugged exterior, the Wasp CF-19 is quite light at five pounds with its magnesium alloy casing. Other features include a shielded yet very daylight-readable 10.4" XGA display (1024x768), recessed and snugly capped ports, tablet with handwriting recognition, a tough swivel and a strong metal clasp that can secure the lid closed or in tablet-up position. The latchable compartment containing the Wi-Fi on/off switch, PC card slot, express card slot and SD reader is another smart addition.

Our test machine was configured as follows: Fedora Linux 7 + Windows XP dual-boot, 1.067GHz Intel Core Duo U2400 ultra-low voltage processor, 1.5GB of RAM, 80GB hard drive and no optical drive (an external USB DVD/CD-RW costs an extra $400).

As mentioned previously, EmperorLinux appears to be the most fanatical vendor as far as offering a rich Linux-based experience, and the Wasp CF-19 lets EmperorLinux show its stuff. In addition to expected features, such as working Fn keys, the Wasp CF-19 has a number of features that are atypical for Linux laptops—for example, the tablet functionality with screen rotation and cellular broadband (EV-DO or HSPDA) and GPS support work out of the box. The custom documentation also is excellent, explaining what does work (and how) and what does not work, saving the user precious time and headaches. If only EmperorLinux would add a custom menu like R Cubed's for custom application installation, system and kernel updates and direct support options, it'd have the best of all worlds.

Pros:

- Tablet works flawlessly despite well-protected display; tablet also works out of the box.
- Custom GNOME application to toggle tablet between landscape and portrait.
- Energy Star-compliant.

Cons:

- Be sure a machine this small will meet your needs.



EmperorLinux Wasp CF-19

Support/warranty: one year of free, unlimited phone and e-mail support from EmperorLinux and three years of hardware warranty from Panasonic included.

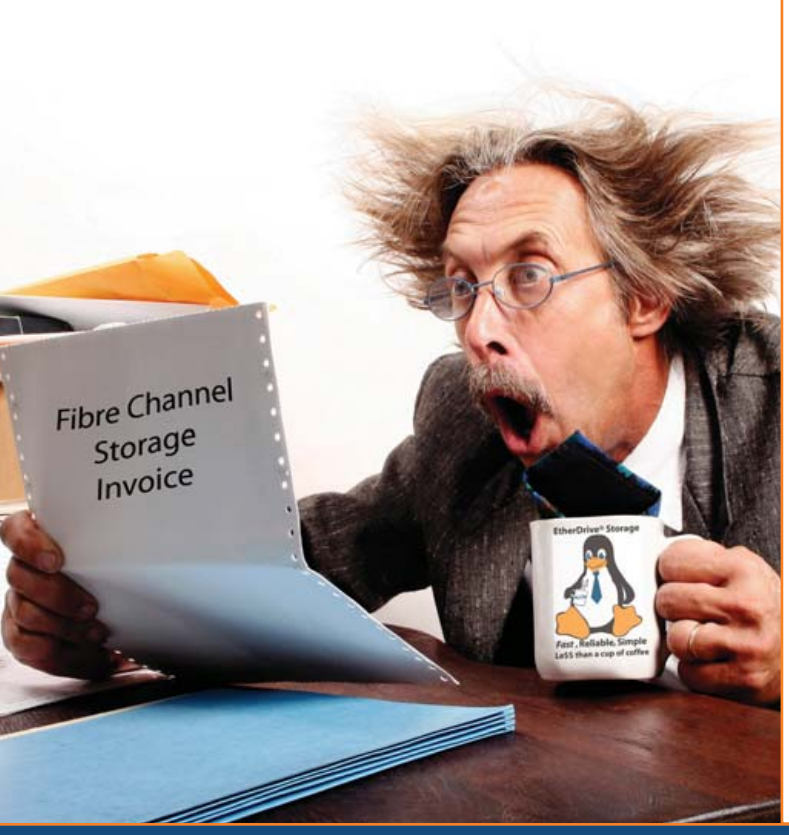
Price as tested: $4,250.

R Cubed XW1760 (ASUS Z84J) and LinuxCertified LC2520DC (ASUS Z84J)—Low-Frills Desktop Replacements

Both LinuxCertified and R Cubed Technologies offer this same ASUS Z84J platform system, a powerful, handsomely styled, mid-level desktop replacement with some nice multimedia boosts. Although the S-Video and HDMI outs will come in handy, the four speakers and subwoofer raised expectations but never rose above tinny computer audio. With its 17" widescreen display and nearly nine pounds of gravitational tug, this is a beast that generally stays put. In addition, although other ASUS machines offer excellent industrial design, less can be said for the Z84J, which feels a bit more Soviet-era than, say, the Dell Latitude due to its solid plastic (not metal or carbon-fiber alloy) construction. The keyboard is comfy enough; however, the touchpad buttons are sticky, and the body is a little bulky. On such a large spread of real estate, it also would be nice to have the option to choose between a pointing stick and touchpad, as Dell and Lenovo offer, but ASUS does not here. Similarly, it's surprising that the Z84J lacks nice features, such as indicator lights for Bluetooth and Wi-Fi or a Wi-Fi shutoff switch. Cellular broadband and 802.11n also are not options for this machine.

The Linux Experience from R Cubed Here is the configuration of the R Cubed test machine: Ubuntu Feisty Fawn, 17" WSXGA+ display, Intel Core 2 Duo T7500 2.2GHz processor, 2GB of RAM, 60GB 5,400rpm SATA hard drive, a DVD-RW Super-Multi drive and the NVIDIA G73M 7600 video card with 512MB of video RAM.

If you want to do more with this machine right out of the box, we recommend the R Cubed experience over LinuxCertified. R Cubed is a scrappy young company that seeks to offer a range of tools that aid in package installation and tech support. For instance, in the Applications menu of the installed Ubuntu Feisty Fawn distribution, R Cubed has its own custom menu item, which in addition to kernel, patch and system updates, offers a package installer for applications, such as Google Earth, VMware Server and multimedia applications with codecs. The system updater works without breaking any of R Cubed's customizations, and soon distribution upgrades will be available



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R Cubed XW1760 (ASUS Z84J)

using this route. There also is a remote support option, which creates an SSH connection to R Cubed, allowing technicians to tunnel securely to the machine to gain shell or VNC access and resolve support issues. Regarding documentation, although R Cubed has a useful knowledge base on its Web site, nothing comes in the box beyond the invoice and login information. Although paper may be passé, we strongly feel that good printed materials specific to the machine in front of you never will go out of style.

Finally, an accurate price from R Cubed was unavailable, as the quoted price from R Cubed for this configuration did not match the last-minute check on the on-line configurator, and some minor hardware selections were unavailable. We regret this lack of information.

Pros:

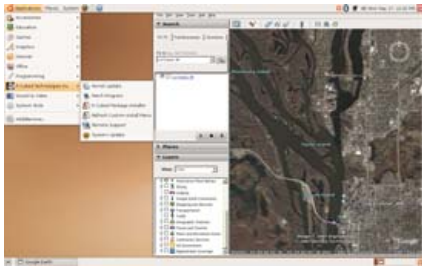
- Dual-boot is an option but only with Windows XP.

Cons:

- No printed documentation.
- No modem or Webcam support under Linux.
- Heavy and bulky.

Support/warranty: one-year parts and labor.

Price as tested: see above for details.



R Cubed Technologies provides a nicely customized desktop experience, including its own menu item for kernel and system updates, package installation, remote support and more.

The Linux Experience from LinuxCertified Here is the configuration of the LinuxCertified test machine: 17" WSXGA+ display, Intel Core 2 Duo T7200 2.0GHz processor, 3GB of RAM, 60GB 7,200rpm SATA hard drive, a DVD-RW Super-Multi drive and the NVIDIA GeForce Go 7700 video card with 512MB of video RAM.

Getting this machine from LinuxCertified means getting a system that's working but with few added luxuries. Customization generally is up to you. Some nice surprises include preloaded Google Earth on the desktop and the myriad preloaded video and audio codecs. On the other hand, hibernation is not enabled, the Wi-Fi on/off function key doesn't work, and the Webcam is not supported. Unfortunately, LinuxCertified takes last prize for documentation—the on-line information is sparse, and nothing at all comes in the box.

Pros:

- Dual-boot is an option but only with Windows XP.

Cons:

- No printed documentation.
- No modem or Webcam support under Linux.
- Heavy and bulky.

Price as tested: $2,499, "Performance Bundle".

R Cubed XW1580 (ASUS S96S)—Value-Oriented, All-Purpose Laptop

The R Cubed XW1580 is the Linux edition of the ASUS S96S platform, preloaded with Ubuntu Feisty Fawn. Sporting a 15.4" WXGA widescreen display, the overall impression of the XW1580 is cheap chic—that is, a little sportier than the very low-end but definitely not Sony-VAIO sexy either. The XW1580's construction is solid, utilitarian and, at nearly seven pounds, heavy for its size. However, if you want to get a feature-filled laptop at a decent price—and you're not a road warrior—this may be your machine.

Our test machine came loaded with Ubuntu Feisty Fawn and equipped with an Intel Core 2 Duo T7300 2.0GHz processor, 2GB of RAM, 80GB 7,200rpm SATA hard drive, DVD-RW drive, and the NVIDIA GeForce 8600M GS with video card with 256MB of video RAM.

Like R Cubed's other machine reviewed here (the XW1760), you can expect an above-average, customized Linux experience with the XW1580. Unfortunately, although nearly all functionality exists under Linux, some of the same limitations as discussed with the XW1760 hold here—no Webcam or modem support under Linux.

Pros:

- Dual-boot is an option but only with Windows XP.
- S-Video TV output.

Cons:

- Keyboard sags a bit when typing.
- Left side has much unused real estate—why not stick in a USB port?
- Touchpad buttons require a lot of pressure.

Support/warranty: one-year parts and labor included.

Price as tested: $1,447.



R Cubed XW1580 (ASUS S96S)

Pros:

- Sensible, ergonomic layout and strong multimedia features for a business machine (for example, S-Video and HDMI outs).
- Excellent 15.4" display.
- Ships with optical scrolling USB mouse.
- Dual-boot with Windows Vista is an option.
- Will ship with machine-specific documentation.
- SDCard/MMC card slot.

Cons:

- No Webcam support yet.

Support: three years of hardware support; three months of no-cost remote support; "best effort support" after three months.

Price as tested: $1,750.

HPC Systems V1J-Linux (ASUS V1J)—Portable Desktop Replacement

At the time of this writing, HPC Systems, a company better known for its servers and high-end workstations, was preparing to market a line of laptops preloaded with Linux. The V1J-Linux is HPC's first batter to the plate, and we can confidently say that HPC has gotten on base with a stand-up double. The V1J-Linux, which is a Linux-loaded ASUS V1J, is a well-built, attractive, full-featured laptop that will work well for those who put functionality over portability, though it is not a beast. It has a sleeker, more appealing design and sufficiently large (in our view) 15.4" WXGA screen when compared with its larger, bulkier cousin, the ASUS Z84J platform, which is found elsewhere in this article. One thing that helps this machine over the ASUS Z84J is its carbon alloy casing, which makes it much lighter (around six pounds) and visually appealing. This also was the only machine we tested with a spill-proof keyboard.

Another bonus feature is the V1J-Linux's RoHS compliance, meaning that it meets the strict European Union specifications for levels of hazardous substances, such as lead, cadmium, mercury and others (see Resources for more information).

Our Ubuntu/Windows Vista Business test machine arrived with an Intel Core 2 Duo T7200 2.0GHz processor, 1GB of RAM, 120GB hard drive, a DVD-RW drive and the ATI RADEON X1700 video card with 256MB of video RAM.

Despite the fact that our review machine was preproduction, it is obvious that HPC Systems has the means and desire to offer a great Linux experience. Our V1J-Linux came dual-booted with Ubuntu Feisty Fawn and Windows Vista Business, with nearly every function working well, including fingerprint scanner, 3-D acceleration, FireWire, Fn keys and so on. Unfortunately, however, the built-in Webcam is not working, and we hope that someone someday will get these ASUS Webcams working once and for all.

ASUS Eee PC 700/701—Long-Awaited Ultra (Ultra) Portable

Darn it! At the time of this writing, ASUS just pushed back the release of its forthcoming Eee PC from September to October 2007, making a review in time for this issue impossible. The Eee PC is a new, ultraportable, Linux-based laptop priced at $259 and up. The lower-end 700 model has 2GB of Flash storage and 256MB of RAM, and the juiced-up 701 model has 4GB of Flash storage and 512MB of RAM. Both models feature the following: preloaded Xandros Linux, Intel



HPC Systems V1J-Linux (ASUS V1J)



Celeron-M 900MHz processor, 7" display, 10/100Mbps LAN, 802.11b/g wireless, three USB 2.0 ports, MMC/SD card reader, VGA out, Windows XP compatibility/drivers, built-in camera (optional on the 700) and a 4-cell battery with three hours of runtime. There are no optical drives, and both models weigh in at two pounds. The word on the "blog street" appears to be that many otherwise Windows users would choose a Linux device for their mobile needs. ASUS projects that dealers should have the Eee PC by late October 2007.

Suggested retail price: starting at $259.

Dell Inspiron 1420 N—Flexible Workhorse Laptop

Although Dell has embraced Linux by offering laptops and desktops with Ubuntu preloaded, we suspect that most of the company is ambivalent at best about selling and supporting Linux machines. Most of the Linux-specialist companies responded promptly to our requests for review machines and information; however, a month's worth of pleading for the same from Dell resulted in no review machine, creative excuses and receipt of information only after a threat of negative publicity. Although the people at Dell are extremely friendly and competent, our impression is that Linux falls far down on their priority list. Furthermore, Dell's sole (yes, one!) Linux-based laptop discussed here offers far fewer options than its Windows counterpart. We fear that Dell will not support Linux with the same kind of passion that our Linux specialists do, resulting in a self-fulfilling prophesy along the lines of "Look, we tried Linux, but nobody bought it! We told you there was no market!" Unless Dell can weave Linux into its "corporate DNA", we predict it will fail in this desktop endeavor.

In addition to commending the ongoing efforts of the Linux hardware specialists, we warmly welcome Dell and Lenovo to the club of Linux laptop providers, happy the big vendors finally see the light.

Despite those criticisms, it is undeniable that Dell offers its popular Inspiron 1420 N (the N designates the Linux version) laptop with Linux preloaded for the same price as its Windows counterpart. More machines may be on the way, but we received no firm commitment about this. In any case, although we were unable to get our hands on a review machine, other reviews have billed the Inspiron 1420 as a workhorse machine that offers a huge range of options and strikes the right balance between display size (14.1" widescreen) and portability (six pounds).

Our virtual test configuration included Ubuntu Feisty Fawn, an Intel Core 2 Duo T5250 1.5GHz processor, 2GB of RAM, a 14.1" widescreen display at 1280x800, 120GB 5,400rpm SATA hard drive, Intel Graphics Media Accelerator X3100, CD-RW/DVD player combo drive and, in honor of John Waters, a "Flamingo Pink" casing.

Yes, Dell, we Linuxers are grateful that you now sell a preloaded Linux laptop. Nevertheless, we think you can do better, because you're still not giving us the Full Monty. Unfortunately, the Linux edition of the Inspiron 1420 has far fewer options than its Windows Vista cousins. Here are some differences between the Windows and Linux versions of the 1420:

- The default hard drive with Windows is 120GB, with a maximum size of 320GB; with Linux, the default is only 80GB and maximum is 160GB. (Insider tip to Dell: Linux users want big storage!)
- On Windows, you can opt for the NVIDIA GeForce 8400M GS or Intel Graphics Media Accelerator X3100 video cards; on Linux, only the latter is available.
- Each of the following features is available for Windows but not Linux: mobile broadband (EV-DO or HSDPA), Webcam, Bluetooth support and Blu-ray drive.

What's more, the only Linux-based OS offered is Ubuntu 7.04, with no dual-boot option available—a major drawback. Furthermore, our contact at Dell tells us that all the functionality works fine under Linux, including the Fn keys, except that the integrated multicard memory readers won't be supported until a later date. Regarding support, Dell offers its typical range of warranties on its hardware for up to four years. As for the software side, Canonical is the entity performing the support with options ranging from no support up to one year of full OS, application and networking support.

Support on configured machine: one-year in-home warranty with service, parts and labor. Also includes 24x7 phone support.

Sample configuration: $1,049.



Dell Inspiron 1420

Other Companies to Check Out

We are disappointed that some great companies decided not to send us evaluation machines and get some free publicity. Despite the snub (yes, you are forgiven because we know you're busy selling computers), we encourage you to consider these firms when making your next Linux laptop purchase.

- **CompAmerica:** this is a very interesting company that, despite not marketing itself within the Linux community, is fully committed to Linux. CompAmerica's CEO, Jack Schulman, is a driven 30+ year industry veteran who has shared with us his passion for meeting the demanding needs of discriminating Linux users. Jack told us that CompAmerica offers Linux on every laptop it sells, including its economy, high-end and "super-exotic" series. One example from the latter is the 20" Tiger Shark 9500 with up to 4GB of RAM, dual NVIDIA Quadro FX Go 2500M GPUs, two hard drives and two optical drives. The option to choose Linux is not marketed heavily on the CompAmerica Web site, but at least the option exists.

- **Polywell Computers:** Polywell offers a wide range of preloaded Linux laptops in nearly every category, such as the 12.1" 4.1-pound PolyNote M212SC ultraportable, the 13.3" 4.2-pound PolyTablet tablet notebook, and the many business and specialty laptops with displays from 14" all the way up to 20". In addition, the five different laptops in the V series all have interchangeable parts (for example, battery packs, optical drives and hard drives).

- **ThinkMate:** ThinkMate features its a versatile Jetbook line of business-oriented 15.5" and 17" laptops. You can load up your laptop with Fedora 7 or SUSE 10.2 on the Linux side and Windows Vista or XP on the Redmond side—a nice touch. All laptops come with a three-year warranty.

- **Sub300.com/Sub500.com:** Although Toronto's Sub300.com/Sub500.com is shy of the press, it has long been a favorite destination for bargain-hunting hardware aficionados. This no-frills firm's laptop offering consists of two configurations of the same ultraportable model: a 3.1-pound device with a 12.1" TFT display running Linspire (its motto is "No Microsoft Mess"), and it maxes out at $1,200. The price is a little steep considering the lack of built-in optical drive and low-end processors (1GHz Via Centaur or Intel Pentium M Centrino 1.4GHz). A rugged notebook to compete with the Panasonic Toughbook also is in the works at the time of this writing.

Let the Good Times Roll

We hope that this information, although partial, will assist in planning your next purchase of a preloaded Linux laptop. You should now have a better idea of what companies sell preloaded Linux laptops, what key models they sell, and how features, functionality and prices vary among models. Although we Linux fanatics cannot get every specific laptop model we want, with some research, most of us can find a machine that gives us the functionality we demand.

You can find a machine you want due to the plethora of companies that now offer Linux laptops, and that number is sure to grow and provide more options from which to choose. Because of this variety, differences exist among vendors in the devices, features, dual-boot policies, prices, extra services, warranties and Linux-based functionality they offer. We cannot recommend strongly enough that you do your homework and keep an open mind. If you follow this advice, you should find yourself in front of a Linux laptop that will keep you productive and happy for years to come. Good luck!■

James Gray is *Linux Journal* Products Editor and a graduate student in environmental science and management at Michigan State University. A Linux enthusiast since the mid-1990s, he currently resides in Lansing, Michigan, with his wife and cats.

Resources

EmperorLinux: **www.emperorlinux.com**

Lenovo: **www.lenovo.com**

R Cubed: **www.shoprcubed.com**

HPC Systems: **www.hpcsystems.com**

ASUS Eee PC: **www.asuseeepc.com**

CompAmerica: **www.compamerica.com**

Polywell: **www.polywell.com**

ThinkMate: **www.thinkmate.com**

Linux on Laptops: **www.linux-laptop.net**

RoHS Environmental Standard: **www.rohs.gov.uk**

On-line Encrypted Backups for Your Laptop

Protect your laptop files with FUSE and an on-line storage service.

BEN MARTIN

Information on a filesystem can be encrypted to protect against unintended disclosure when a laptop is stolen; however, doing so doesn't allow you to access the files you've been working on if someone steals your laptop. If you have been traveling for a few weeks, making modifications to source code or office documents with your laptop, and it is lost or stolen, you still need to be able to access those updated files when you return home. On the other hand, if your laptop isn't stolen, you probably would like the peace of mind knowing the hard disk in the laptop is not the single point of failure for your important changes.

This article describes how to set up a system allowing backups to one or more on-line storage providers. You can choose either a free on-line storage provider or a paid service, depending on the consequences of losing your data or not having guaranteed immediate access to your backups.

You might find that many Internet connections made available to you when traveling have a very "protective" packet filtering system. For example, some hotels will filter all traffic that is not HTTP or HTTPS. Many on-line storage systems are made accessible over HTTP using the same HTTP operations performed by Web browsers. So, you still can upload your changes even when using very restrictive Internet connections. In this situation, other solutions, such as direct use of rsync over SSH, most likely will be filtered out.

One of the combinations described here should work with the most restrictive Internet connections. Two applications of on-line backups come to mind. If you are working on some documents or a smallish code tree, using Omnidrive for storage is a good free backup solution. If you have a nice digital camera and an on-line storage space that is larger, you can back up digital pictures incrementally as you travel. So, if the external 80GB drive to which you transfer your digital pictures goes missing, you won't lose your memories. The latter requires a reasonably fast (and free-of-charge) Internet connection at your hotel and that you leave the laptop on to upload overnight.

The key to making access to storage easy is using FUSE to mount the on-line storage service. Using FUSE makes all storage services look the same (or similar, to be more accurate) to the higher-level encryption and synchronization software. However, some FUSE filesystems for mounting on-line storage offer slightly different implementations, which might require some working around at higher levels.

Because you are backing up important data to a server you don't control or perhaps fully trust, the next layer should provide security to your precious data. The eCryptfs filesystem was described in the April 2007 issue of *Linux Journal*. EncFS is a FUSE filesystem offering filesystem encryption. Both eCryptfs and EncFS take an existing filesystem (the base) and offer a new filesystem (the encrypted filesystem). Any data that is written to the encrypted filesystem is encrypted transparently and stored onto the base filesystem. Reading data will decrypt the information transparently from the base filesystem.

So, you can have storage mounted as FUSE (call this ~/rawfs) and then remounted with EncFS (at another mountpoint, ~/backupfs). Files copied to ~/backupfs are encrypted and saved to ~/rawfs, which then

saves them to the on-line storage (Omnidrive, GMailfs, sshfs, Openomy, Amazon S3—whichever you mount using FUSE at ~/rawfs).

The simplest way to keep your backup fresh is to use rsync(1) from your local data (perhaps in ~/documents) to your encrypted on-line filesystem.

Testing for this article was performed on a Fedora 7 machine. Some of the commands shown here, such as package installation commands, may be specific to the Fedora distribution.

Mounting Web Storage

Depending on your Linux distribution, you may need to add your user to the fuse group to be able to mount FUSE filesystems as a nonroot user. On Fedora 7, you would run the following command to enable the user ben to mount FUSE filesystems:

```
usermod -a -G fuse ben
```

Next, let's examine some different on-line storage providers and how to mount them with FUSE.

OmniFS

OmniFS allows you to mount the Omnidrive storage provider as a FUSE filesystem. Installation and use of OmniFS goes like this:

```
$ tar xjvf omnifs-0.3.0.tar.bz2
$ cd ./omnifs-0.3.0
$ ln -s /usr/include/fuse /usr/local/include/fuse
$ ./configure
$ make

$ su -l
# make install
# ldconfig

# cp sample.cfg ~ben/my-omnifs.cfg
# chown ben.ben ~ben/my-omnifs.cfg
# exit

$ id -u -n
ben
$ cd ~
$ edit my-omnifs.cfg
...
change login, password, api-key and api-private-key
set
omnifs-log-file = /home/ben/omnifs.log

either comment out the proxy setting
or set proxy settings to be valid

...
$ mkdir ~/rawfs
$ omnifs -c my-omnifs.cfg ~/rawfs
```

Building omnifs fails to find FUSE during configure unless I create the link in /usr/local.

To configure the FUSE filesystem, first log in to Omnidrive's Web interface (**web.omnidrive.com**), and note the API and API-private keys for use in the configuration file. After logging in, the keys are available by clicking the Settings button in the top right of the browser and then the API tab in the center of screen.

By default, the omnifs command runs in the foreground, so it blocks the terminal as long as the FUSE mountpoint is valid. After running the omnifs executable to mount the FUSE filesystem, the remote storage appears just like any filesystem:

```
$ cd ~/rawfs
$ date >| foo.txt
$ cat foo.txt
Thu Aug 23 17:50:23 EDT 2007
$ ls -l
total 0
drwx------ 0 ben ben  0 2007-08-31 03:15 Downloads
-rwx------ 0 ben ben 29 2007-08-31 08:50 foo.txt
```

I found that omnifs occasionally can hang at "DEBUG: OMNI_ReadDir Called" in its log file. Restarting the omnifs executable usually helps get things going again.

Listing 1. Using sshfs to Mount an SSH Server

```
local$ ssh-agent bash
local$ ssh-add .ssh/myserv
...
local$ ssh myserv.example.com
ex.com$ mkdir online-storage
ex.com$ exit

local$ sshfs \
 ben@myserv.example.com::/home/ben/online-storage \
 ~/rawfs -o idmap=user

local$ date >| ~/rawfs/datefile1.txt
local$ fusermount -u ~/rawfs
local$ ssh myserv.example.com
ex.com$ cat online-storage/*txt
Fri Aug 24 17:16:40 EDT 2007
```

Listing 2. A Little Script to Mount Your sshfs

```
$ cat ~/bin/mount-sshfs-example.sh
#!/usr/bin/ssh-agent bash
ssh-add .ssh/myserv
sshfs \
ben@myserv.example.com:/home/ben/online-storage \
  ~/rawfs -o idmap=user
```

SSH FUSE Filesystem

Using SSH as the underlying transport for the FUSE filesystem limits usage to Internet connections that do not filter out non-Web traffic.

Given that you can use SSH directly with rsync, you might be wondering why bother with FUSE at all. Using SSH protects the transport of your information to the SSH server. Note that once the files you rsync to the server have been sent, they are not encrypted on the

server's filesystem. If you don't have complete faith in the security of the SSH server, using sshfs to provide FUSE access lets you use the same cryptography discussed in the next section to protect your backups on the SSH server. Also, having all of your on-line storage accessible through FUSE lets you quickly change where you are storing an on-line backup without affecting the rest of the system.

In Fedora, sshfs already is packaged and can be installed with yum. Installation from source follows the standard configure path:

```
# yum install fuse-sshfs
```

Or:

```
$ ./configure && make;
$ su -l
# make install
```

Assuming you are using public keys on the server into which you are ssh-ing, starting to use sshfs is easy. As shown in Listing 1, I first add the server's key to my SSH agent before ssh-ing into the server and creating a directory to use for my on-line storage. I exit the connection and mount the SSH server to ~/rawfs and touch a file in a predictable way. The last command is ssh-ing into the server again to verify that the date has been added to a file in the on-line storage directory.

The mounting of sshfs can be tucked away into a script file, as shown in Listing 2. This can be convenient if you do not have a passphrase on the SSH key or if you do not always add (or want to add) that SSH key to your SSH agent.

Security

If you are running a 2.6.20 kernel or later, eCryptfs should be ready for use without any setup work. Running a 2.6.22 Fedora 7 updated kernel, I had major problems getting eCryptfs to work properly where the base filesystem was stored on a FUSE filesystem. When I did get eCryptfs to mount, there were errors with trying to use rsync to the eCryptfs filesystem, which finally resulted in a kernel oops. I have eCryptfs working fine using a local ext3 filesystem to store its encrypted data, so I suspect it is an issue with eCryptfs and FUSE interaction. Depending on which distribution you are running, setting up eCryptfs to allow nonroot users to mount an encrypted filesystem also can require some tinkering with PAM.

EncFS is a FUSE filesystem that takes a "raw" filesystem and presents a new filesystem. Any files created on the new filesystem will be encrypted and stored to the raw filesystem. EncFS requires FUSE, OpenSSL and rlog. The FUSE EncFS filesystem can be installed either from your distribution's package repository or manually, like this:

```
yum install fuse-encfs
```

Or:

```
tar xzvf rlog-1.3.7.tgz
cd rlog-1.3.7
./configure && make
make install
cd ..
tar xzvf encfs-1.3.2-1.tgz
cd encfs-1.3.2
./configure && make
make install
```

The first time you attempt to mount a raw filesystem to an encrypted filesystem, EncFS will ask you what level of cryptography you desire and what passphrase to use. The same command is used to create an encrypted filesystem and to mount one. Subsequent mounts of the raw filesystem with EncFS will prompt you only for the passphrase. Initial mounting and remounting of EncFS on a rawfs (backed at the time by sshfs) is shown here:

```
$ encfs ~/rawfs ~/backupfs
Creating new encrypted volume.
Please choose from one of the following options:
 enter "x" for expert configuration mode,
 enter "p" for pre-configured paranoia mode,
 anything else... will select standard mode.
?>

Standard configuration selected.

Configuration finished.
The filesystem ... has the following properties:
Filesystem cipher: "ssl/blowfish", version 2:1:1
Filename encoding: "nameio/block", version 3:0:1
Key Size: 160 bits
Block Size: 512 bytes
Each file contains 8 byte header with unique IV data
Filenames encoded using IV chaining mode.

Now you will need to enter a password ...
You will need to remember this password, ...
no recovery mechanism.
However, the password can be changed
later using encfsctl.

New Encfs Password:
Verify Encfs Password:
$ date > backupfs/datetest.txt
$ cat backupfs/datetest.txt
Fri Aug 24 20:44:33 EDT 2007
$ ls -l rawfs
total 4
-rw-rw---- 1 ben 505 37 2007-08-24 06:27 K9dmA...
$ fusermount -u backupfs
$ encfs ~/rawfs ~/backupfs
EncFS Password:
$ ls -l ~/backupfs
-rw-rw---- 1 ben 505 29 2007-08-24 06:27 datetest.txt
```

Performing the Backup: Synchronization

We now have a ~/backupfs filesystem that encrypts anything written to it and stores it on an on-line storage system somewhere. A great tool for keeping your on-line backup up to date is rsync(1).

The rsync manual page states: "The rsync remote-update protocol allows rsync to transfer just the differences between two sets of files across the network connection."

In our case, both the data to be backed up and the place to which we are backing up appear through the Linux kernel. Because ~/backupfs needs to read and write to the Internet, we very much would like to limit the amount of data that is written to it.

Some differences between a normal Linux kernel filesystem like ext3 and our layered setup might have to be worked around with

command-line options to rsync. Listing 3 shows an rsync on an EncFS, which is using sshfs to provide the on-line storage. The first time rsync is run, the whole file is uploaded to the on-line storage. The second time, only some metadata is sent and received.

The -a option to rsync is similar to the -a option to the cp command; it attempts to preserve everything in the source filesystem at the destination. The --no-g command-line option to rsync tells it not to try to sync the destination file's group to the source file's group. In this case, the sshfs does not allow me to change the group of the destination file, so rsync would generate a warning when it failed to set the remote file's group. The --delete-after cleans up any files that exist only in the on-line storage filesystem. In this case, I also use --include to sync only the plain-text files. This can be quite handy for keeping backups of only OpenOffice.org documents in a larger filesystem. Another rsync option that can be invaluable is --modify-window=n, where the parameter n is the number of seconds that the two timestamps can differ between the local and remote files and still be considered the same. When using a filesystem showing on-line storage, the modification time might range from not being perfectly accurate to being a few days off. Setting the --modify-window correctly can hide these slight timestamp drifts or large fixed timestamp offsets and allow rsync to continue to work efficiently.

Conclusion

Running EncFS on top of OmniFS requires some special parameters when first mounting the EncFS. The main issue I found with using the default settings for EncFS was that file contents, when read back, would sometimes have trailing garbage. When using OmniFS and first creating the EncFS, choose expert mode, cipher=AES, keysize=256, blocksize=4096, filename encoding=Stream, filename IV chaining=Yes, per-file IV=no and block authentication code headers=no. The main issues seem to stem from the per file IV settings and something going missing with the round-trip latency of OmniFS. Listing 4 shows some combinations of expert mode settings to EncFS when using OmniFS as the base filesystem and the resulting filesystem interaction.

Some filesystem people dislike FUSE because of the extra context switches it can introduce. The use of two FUSE filesystems layered on top of each other, as shown in this article, means there is quite a bit of context switching going on in order actually to get data to the network. For the purposes of this article, the overhead of these context switches is irrelevant when compared to Internet connection speed.

Listing 3. Using rsync to Back Up Data to an Encrypted On-line Filesystem

```
$ rsync -av --delete-after \
  --include="*.txt" --no-g  \
  small/ ~/backupfs
...
boysw10.txt

sent 49056 bytes  received 48 bytes
total size is 48923

$ rsync -av ...
sent 83 bytes  received 26 bytes
total size is 48923
```

Listing 4. Some EncFS Options and Their Results When Using OmniFS to Mount the On-line Storage

```
x, 1, 256, 4096, 2, R, n, R == OK
x, 1, 256, 4096, 1, n, R, R == BAD
x, 1, 256, 4096, 3, n, n, R == OK
x, 1, 256, 4096, 3, R, n, R == OK
```

Encrypting your home directory can give peace of mind in the event that your laptop is stolen. With on-line backups, you also are protected against losing your important changes along with your laptop or its crashing hard disk.

By using FUSE to expose the on-line storage as a filesystem, the encryption and synchronization can be left intact when you decide to change your on-line storage provider. The OmniFS filesystem uses HTTP to communicate with the on-line storage provider, so it should work even when your Internet connection has aggressive packet filtering.■

Ben Martin has been working on filesystems for more than ten years. He is currently working toward a PhD combining Semantic Filesystems with Formal Concept Analysis to improve human-filesystem interaction.

Resources

"eCryptfs: a Stacked Cryptographic Filesystem" by Mike Halcrow, *LJ*, April 2007: **www.linuxjournal.com/article/9400**

Mounting eCryptfs as a Nonroot User: **ecryptfs.sourceforge.net/ecryptfs-faq.html#nonroot**

Openomy Storage Service: **www.openomy.com**

OpenomyFS: FUSE Filesystem for Openomy: **mauricecodik.com/projects/ofs**

GMailFS, Mount Your Gmail Account: **richard.jones.name/google-hacks/gmail-filesystem/gmail-filesystem.html**

FUSE: Filesystem in Userspace: **fuse.sourceforge.net**

Ruby FUSE Bindings: **rubyforge.org/projects/fusefs**

Create a Filesystem inside a Berkeley DB File: **www.kernel.org/pub/linux/kernel/people/jgarzik/fs**

Omnidrive, Free On-line Storage: **www.omnidrive.com**

OmniFS Home: **users.tpg.com.au/panyam/omnifs.html**

FUSE Filesytem for Mounting SSH: **fuse.sourceforge.net/sshfs.html**

EncFS FUSE Filesystem Home Page: **arg0.net/wiki/encfs**



Getting Wireless the NDISwrapper Way

How to make NDISwrapper work with different wireless devices.

FEDERICO KEREKI

CITY SKYLINE ©ISTOCKPHOTO.COM/JASON BENEDICT

Using a wireless connection on Linux still is a dicey thing, and you must acknowledge the fact that you probably will have to go a non-open-source software direction, if you want to have any chance of getting connected. A lot of development is happening in this realm, but let's face it, making wireless devices work natively with open-source drivers is not something you can count on, at least for the time being.

What's the reason for this state of affairs? Just as with graphics cards, there are many factors. Vendors are quite interested in offering newer devices, but the majority of them do not care about Linux and have a Windows-only mindset. Furthermore, if you purchase a laptop, you may not even have the option to choose the card, so you have to make do with whatever you are dealt. Finally, developers cannot produce the needed software when manufacturers won't release the specs, APIs and so on for their products, and this documentation almost never is available.

Thus, unless you are quite lucky and happen to have one of the few open-source-supported options, NDISwrapper probably will be your best option; however, it's no surefire silver bullet. NDISwrapper tries to provide a wrapper around Windows drivers, so Linux can use them as if they were native ones. If you are lucky (okay, not so much lucky, as many drivers seem to work), your Linux machine will think it has perfectly fine drivers and will use them.

Though the program itself is open source, this usage of proprietary drivers is objectionable (maybe even not 100% legal?) and obviously not guaranteed. Furthermore, it's still a bit of a hit-or-miss, not very well documented and somewhat obscure method. There's no fancy graphic interfaces here, only old-fashioned command-line work, with many possibilities for mistakes. Taking all of this into account, it's no wonder many people become conscientious objectors of NDISwrapper or end up not being able to make it work.

Hopefully, in the near future, this will be a moot point, and we will have full open-source software for most, if not all, wireless cards. Certainly, such drivers exist for a select few. In the meantime, we have to make do with this sort of kludge—even though NDISwrapper is brilliant, it's a pity we have to rely on such a program—and wait for better times.

I recently got a somewhat old eMachines M5305 laptop, and as I had to work in a wireless-only office, I had no option but to get wireless going. In this article, I explain how I installed two different kinds of cards (USB and PCI) and got them to function with NDISwrapper. I won't dwell on the many other alternatives I tried (which got me nowhere) and focus on the NDISwrapper solution. Being purely practical, I needed my box to work—open-source software or not.

What Is NDISwrapper?

NDISwrapper stands for Network Driver Interface Spec Wrapper. A wrapper is a technical name for a piece of software that, loosely speaking, allows you to use something in a somewhat different way. Using Windows drivers under Linux certainly qualifies as "using something in a somewhat different way".

You can find NDISwrapper in most modern distributions. Either use the provided repositories, or go to the NDISwrapper site (see Resources), download the source files and install them yourself. As a matter of fact, even though I use OpenSUSE 10.2 and NDISwrapper was readily available, I opted to go that route myself, so as to get the most up-to-date version. At the time of this writing, the current stable version stands at 1.47, and there is a 1.48RC2 release candidate in the works, but I decided to go with the former.

If you already had a version of NDISwrapper on your system, it might be best to uninstall it first (using the tools in your distribution—I used YaST), and then, as a common user, go to wherever you downloaded the file, and do the following:

```
tar zxvf ndiswrapper-1.47
cd ndiswrapper-1.47
make distclean
make
```

Finally, as root, type `make install`.

First Experiment: the USB Method

I went to a nearby computer shop and found a cheap, nice USB wireless adapter, Allied Telesyn's AT-WCU201G model, which supports speeds up to 108Mbps and is compatible with IEEE 802.11, 802.11b and 802.11g. Of course, today, speeds of 54Mbps are more common, so it's nice having an extra speed reserve resource.

Because this is a USB device, you can use the lsusb command to get the device ID. Insert the device at any USB slot, and do:

```
lsusb
Bus 003 Device 002: ID 3242:4001
Bus 003 Device 001: ID 0000:0000
Bus 002 Device 001: ID 0000:0000
Bus 001 Device 001: ID 0000:0000
```

It's pretty clear our device's ID is 3242:4001. If you want more information—there's lots of it—about the device, try `lsusb -d 3242:4001 -v`, and you can verify the manufacturer, product code, serial number and so on. It's highly likely that other people already will have tried their hands at getting the device to work, so I Googled it on-line to see if there was any help or known good Linux drivers. I didn't find any useful references, but I went on ahead anyway—did you expect to give up so easily?

If you're following along, you will need a Windows XP driver, both the .inf and the .sys files. Fortunately, the product I chose includes a CD with several appropriate drivers, and it's just a matter of copying it to disk. Note that possibly not all Windows drivers will work or be stable. Sometimes you may discover you need to try alternate drivers to get your card to work. Also, the vendor might have included the needed files within an EXE file (try unzipping it and see if you get what you need) or a CAB file.

In my particular case, it was easy—just a matter of copying some files (atiwu.inf and atiwu.sys) and then typing `ndiswrapper -i atiwu.inf`, followed by `ndiswrapper -m` and then `ndiswrapper -l` to list all drivers. I got:

```
atiwu : driver installed
        device (3242:4001) present
```

which shows that the device was recognized and the driver was installed. Now, it's time to let Linux know more about the new device. Because I use OpenSUSE, I opened YaST and went to Network Devices→Network Card→Add, and selected the following:

- Device type: wireless.
- Configuration name: 0 (so the device will be known as wlan0).
- Hardware configuration name: static-2 (whatever).

There's no fancy graphic interfaces here, only old-fashioned command-line work, with many possibilities for mistakes.

- Module name: ndiswrapper (most important).

Do not choose PCMCIA or BUS. Then, go through the next screens (pick either DHCP or an IP, specify your DNS servers and so on), until you come to the Wireless Device Settings form. There, you probably will have to set the following:

- Operating mode: managed (ad hoc would work for a peer-to-peer network).
- Network name: Guiamovil (the name of the network to which I wanted to connect).
- Authentication mode: WPA-PSK (open would work for an unrestricted, unprotected, passwordless network).
- Key input type and encryption key: whatever the network administrator tells you to use. (Of course, you don't need this for an "open" network.)

You can leave all these changes out, however, if you don't know to what network you will be connecting. Simply exit the program, save all the changes, and you will have device wlan0 available. We are almost there!

How Do I Connect?

If you made it this far, you can use the wireless tools, which include iwconfig and iwlist, to configure your device and search for available networks. (Of course, there are many similar tools, some even have graphic interfaces; look around if you so desire.) In my situation, I already knew the network to which I wanted to connect, but in other cases (Wi-Fi hot areas at airports, for example), you would need to look around to find one.

You can scan for networks with `iwlist wlan0`, and you'll get something like this:

```
wlan0  Scan completed :
       Cell 01 - Address: 00:16:B6:DB:10:93
                 ESSID:"linksys"
                 Protocol:IEEE 802.11g
                 Mode:Managed
                 Frequency:2.437 GHz (Channel 6)
                 Quality:0/100 Signal level:-84 dBm Noise level:-256 dBm
                 Encryption key:off
                 Bit Rates:1 Mb/s; 2 Mb/s; 5.5 Mb/s; 11 Mb/s; 18 Mb/s
                           24 Mb/s; 36 Mb/s; 54 Mb/s; 6 Mb/s; 9 Mb/s
                           12 Mb/s; 48 Mb/s
                 Extra:bcn_int=100
                 Extra:atim=0
       Cell 02 - Address: 00:4F:67:00:C1:AA
                 ESSID:"Guiamovil"
                 Protocol:IEEE 802.11g
                 Mode:Managed
                 Frequency:2.437 GHz (Channel 6)
                 Quality:0/100 Signal level:-67 dBm Noise level:-256 dBm
                 Encryption key:on
                 Bit Rates:1 Mb/s; 2 Mb/s; 5.5 Mb/s; 11 Mb/s; 6 Mb/s
                           9 Mb/s; 12 Mb/s; 18 Mb/s; 24 Mb/s; 36 Mb/s
                           48 Mb/s; 54 Mb/s
                 Extra:bcn_int=200
                 Extra:atim=0
                 IE: WPA Version 1
                     Group Cipher : WEP-40
                     Pairwise Ciphers (1) : WEP-40
                     Authentication Suites (1) : PSK
```

Great, the connection I wanted is there (the second one, Guiamovil), and also another open, unprotected one called Linksys. (The unchanged name is a giveaway that the wireless router was installed without any specific configuration.)

If you would rather use the command line, iwconfig allows configuring the wireless device. Try `iwconfig --help` or `man iwconfig` to learn more about this. For example, I could get the same results that I did with YaST by typing:

```
iwconfig wlan0 essid "Guiamovil" mode managed key
"s:THESECRETPASSWORD" commit
```

Now, you simply can ping any site to check how the device is working or connect to the Web and surf along.

Second Experiment: the PCMCIA Method

A friend of mine loaned me a PCMCIA card, so I could test a different kind of device. I first thought about removing the USB driver and setup and then installing his card, but that would have been sort of lame. Anyway, just to make sure the card worked, I tried it, starting with:

```
ndiswrapper -r atiwu
rm /etc/modprobe.d/ndiswrapper
cd /path.where.you.downloaded.ndiswrapper
make uninstall
make clear
make
make install
```

to get back to square zero. I then inserted the card into its slot and used the `lspci` and `lspci -v` commands to learn more about it. I found the card at the bottom of the listing, and the second command produced its ID (11ab:1faa):

```
$ lspci
00:00.0 Host bridge: ATI Technologies Inc AGP Bridge
                     [IGP 320M] (rev 13)
00:01.0 PCI bridge: ATI Technologies Inc PCI Bridge
                    [IGP 320M] (rev 01)
00:07.0 ISA bridge: ALi Corporation M1533/M1535 PCI to
                    ISA Bridge [Aladdin IV/V/V+]
00:08.0 Multimedia audio controller: ALi Corporation M5451
          PCI AC-Link Controller Audio Device (rev 02)
00:09.0 Modem: ALi Corporation M5457 AC'97 Modem Controller
00:0a.0 CardBus bridge: ENE Technology Inc CB1410 Cardbus Controller
```

```
00:0d.0 USB Controller: NEC Corporation USB (rev 43)
00:0d.1 USB Controller: NEC Corporation USB (rev 43)
00:0d.2 USB Controller: NEC Corporation USB 2.0 (rev 04)
00:0e.0 Ethernet controller: Broadcom Corporation BCM4401
                              100Base-T (rev 01)
00:10.0 IDE interface: ALi Corporation M5229 IDE (rev c4)
00:11.0 Bridge: ALi Corporation M7101 Power
                Management Controller [PMU]
01:05.0 VGA compatible controller: ATI Technologies Inc
                                   Radeon Mobility U1
02:00.0 Ethernet controller: Marvell Technology Group Ltd.
               88w8335 [Libertas] 802.11b/g Wireless (rev 03)
$ lspci -s 02:00.0 -v
02:00.0 Class 0200: 11ab:1faa (rev 03)
```

This time, Googling for 11ab:1faa was lucky. I found several references saying that the card worked well, so I went ahead and installed it using the same method as with the USB card. It worked just fine—it was almost anticlimactic.

Now, back to the original idea of installing both devices at the same time. I wasn't even sure if NDISwrapper could handle two drivers at the same time, and when I searched the Web, I found nothing. Plowing ahead, I decided to experiment a bit. It turns out that the /etc/modprobe.d/ndiswrapper file read:

```
alias wlan0 ndiswrapper
```

So, I added an `alias wlan1 ndiswrapper` line to it, just to see if it made any difference. I went back to the beginning (uninstalled everything), rebooted (just in case) and started again. After setting up both devices, I tried `iwconfig` and happily saw that both interfaces were recognized. I could remove either of them, and the other still worked fine. I noted that the Allied Telesyn USB device was more sensitive—it could find more remote networks—than the Netgear card, but I guess that's reasonable, as the former is newer and could be expected to be more potent.

Conclusion

Even though wireless devices are still a low point for Linux, using NDISwrapper provides a good solution, if you are not dogmatic about proprietary binary drivers or using Windows software on your Linux box. I would prefer an OSS solution, but I can't wait for it. There are no guarantees, of course, but my experiments convinced me that getting wireless to work should be an easy job, and I was able to make two different devices work at the same time, which attests to the quality of NDISwrapper.■

Federico Kereki is an Uruguayan Systems Engineer, with more than 20 years' experience teaching at universities, doing development and consulting work, and writing articles and course material. He has been using Linux for many years now, having installed it at several different companies. He is particularly interested in the better security and performance of Linux boxes.

Resources

NDISwrapper: **ndiswrapper.sourceforge.net**

Wireless Tools for Linux:
www.hpl.hp.com/personal/Jean_Tourrilhes/Linux/Tools.html



My Triple-Boot Laptop

A triple-boot laptop with QEMU on which to run applications and learn Linux.

P. SURDAS MOHIT

I bought a new laptop in spring 2006 and decided to make a serious attempt to switch to Linux, or at least make it my primary operating system. I already had some basic experience, having used Linux servers at school for a few years, but I had no experience administering my own machine. My goals for the system were simple. First and foremost, it had to let me accomplish all my work-related tasks: computational programming, image manipulation and producing academic papers and presentations. Second, it had to fulfill my entertainment needs: playing music and video of various types (including streaming media), playing and backing up DVDs, playing games and making phone calls over the Internet. In addition, I had the more general, underlying goal of improving my understanding of the operation of my computer and reducing my reliance on proprietary software.

As it turns out, my choice of hardware had a big impact on the result. My laptop is a Compaq Presario V2630CA, with the following specifications:

- 1.8GHz AMD Turion 64 processor
- 512MB of DDR RAM
- ATI RADEON XPRESS 200M
- 80GB hard drive
- DVD R/RW and CD-RW combo drive with double-layer support
- 14" display
- 56k modem
- Integrated Realtek Ethernet card
- Integrated Broadcom BCM4318 wireless card

After much trial and error, my current laptop is a triple-boot system, featuring Windows XP, Ubuntu 7.04 (Feisty Fawn) and Arch Linux 2007.08 (don't panic).

Installation and Hardware

The first decision to make was which Linux distribution to install. In the end, I chose Ubuntu. I had heard some pretty good things about it, particularly with respect to its package manager and hardware recognition. Setting up the dual-boot system was pretty easy. The computer came with Windows pre-installed, so all I needed to do was shrink the Windows partition and create a Linux partition structure. I used GParted, the GNOME partition editor, which is very easy to use (Figure 1) and can non-destructively resize partitions formatted with any common filesystem, including NTFS, the proprietary filesystem used by Windows XP and Vista. You shouldn't expect any data loss, but nevertheless, it's a good idea to back up the partition before resizing it. You can burn a bootable GParted CD or run it from the Ubuntu Live CD/DVD.

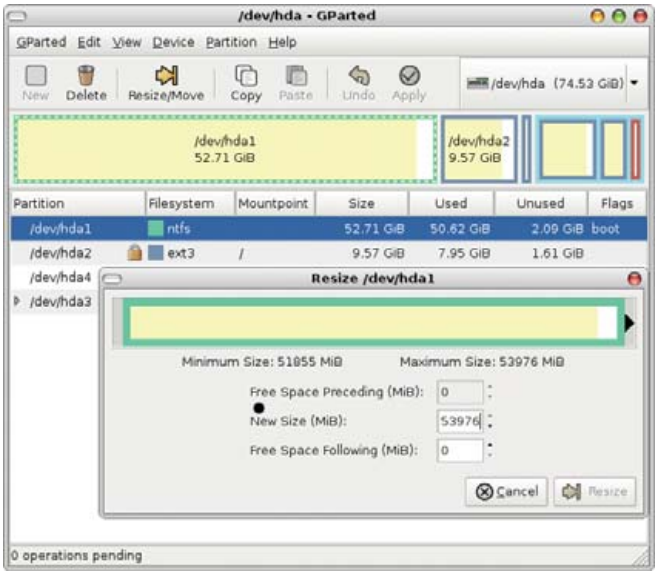


Figure 1. Resizing a Windows XP Partition Using GParted

Next, I created root and swap partitions in the remaining space—the minimum needed by Linux systems—and installed Ubuntu. I later deleted the recovery partition that came with the computer and replaced it with a small shared partition formatted with the FAT32 filesystem, an older DOS filesystem to which both Windows and Linux can write. When I next repartitioned my hard drive to install a third operating system (Arch), I replaced this with a home partition shared by both Linux distributions.

The Ubuntu install was pretty painless, and almost all of my hardware worked right away. The one exception was my wireless card. I soon discovered that it doesn't have a reliable open-source driver and is one of the least compatible with Linux. Ubuntu comes with a native kernel module for the card (bcm43xx), but it worked only sporadically and tended to cause my system to freeze up completely. I tried both the open-source NDISwrapper and Linuxant's proprietary DriverLoader, both of which operate as wrappers for the Windows driver. For $20, you can get a lifetime license for DriverLoader. Both require use of Windows driver files, bcmwl5.inf and bcmwl5.sys, which can be copied directly from your Windows partition (if you have one) or downloaded from the Web.

To install DriverLoader, simply go to Linuxant's Web site and download the installer. NDISwrapper is fully open source and comes pre-installed on Ubuntu. To load the Windows driver, simply use:

```
ndiswrapper -i bcmwl5.inf
```

I discovered that NDISwrapper works better in low-signal environments with unencrypted or WEP-encrypted networks, while DriverLoader is more reliable for connecting to WPA2 networks. If you use the GNOME desktop, NetworkManager is an excellent tool for connecting to encrypted or unencrypted wireless networks and making VPN connections (Figure 2). Simply install it with:

```
sudo apt-get install network-manager-gnome
```

Then, start it with:

```
nm-applet&
```

I found it to be more reliable than KDE's Wireless Assistant and less of a hassle than using scripts, as I travel a lot and often need to connect to new wireless networks.

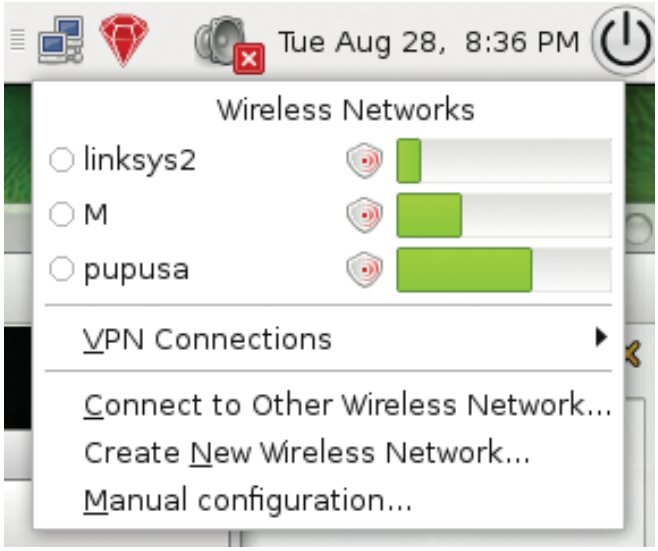


Figure 2. Left-click the NetworkManager applet to display and connect to available wireless networks.

One of the great things about Ubuntu is that once you install it, you're immediately up and running with most of the stuff you'll need for day-to-day operation, and you're notified automatically when software updates become available. You can use Sun Microsystems' OpenOffice.org as your office suite, the GNU Image Manipulation Program (GIMP) for image manipulation, Totem to watch videos, Novell's Evolution or Mozilla Thunderbird for e-mail, Mozilla Firefox for Web browsing and so on. If you're running the 32-bit version of Ubuntu, it's also easy to install plugins for on-line streaming video, such as Flash and Windows Media. I'd recommend installing MPlayer and its Firefox plugin, which plays most video formats; Flash requires a separate plugin. At the time that I was running 64-bit Ubuntu, I was able to use Flash only by creating a 32-bit chroot environment. Once I created the shared FAT32 partition, it was fairly simple to share the data for my e-mail client and Web browser, Mozilla's Thunderbird and Firefox, between Linux and Windows.

Arch Linux

There are several reasons to use two Linux distributions on your laptop. My main reasons for installing Arch were: 1) I wanted to try more Linux distributions to get an idea of which would be best for me; 2) Arch is a particularly, fast, lightweight, leading-edge distribution with an excellent package manager; and 3) it is very different from Ubuntu and less newbie-friendly, providing a great opportunity for learning and customization, and it's a potential intermediate step to Gentoo or other source-based distributions.

The Arch experiment proved to be quite useful for all of these reasons, yet it's easier to use than I expected. I had psyched myself up for a tough install, but it was only marginally more demanding than Ubuntu. After selecting which packages to install from the CD (it recommends installing only the base set of packages during the install process), the installer allows you to edit certain key configuration files. The main one, which encompasses almost all of the major configuration, is rc.conf. This file contains your time preferences, network configuration and selection of kernel modules and dæmons to load at startup. The most important thing is to get your Internet connection up and running by adding the kernel module for your Ethernet card to the list and entering your network information.

Once you've installed the base system, you can install any other applications as you need them. It will not boot automatically to a display manager, such as the GNOME Display Manager (GDM), so you should be pretty comfortable using a console. The package manager pacman is very easy to use. To install a package simply execute the following:

```
# pacman -S package
```

Then, to update your system:

```
# pacman -Syu
```

Pacman resolves package dependencies automatically and asks for confirmation to install the list of packages. You also can install groups, such as gnome, kde and xfce4.

In addition to the supported packages, Arch also has the Arch User-community Repository (AUR), which contains user-contributed templates allowing you to install additional applications easily from source using the makepkg utility. To install them, simply download the PKGBUILD file from the AUR Web site, and run the following in the directory to which you downloaded it:

```
# makepkg -si
```

The -si options are optional and instruct makepkg to install any dependencies that are in the supported Arch repositories and to install the package itself after compiling it. There also are pacman front ends that add support for AUR, allowing you to install AUR packages and keep them up to date easily. For example, yaourt lets you upgrade all packages by executing:

```
# yaourt -Syu -aur
```

Software: Open Source vs. Proprietary

I need a certain amount of software for scientific and graphical purposes, and there's a large amount of open-source and proprietary software out there, some of which my institution had licenses for. One of my goals in using Linux was to use as much free, open-source software as possible. I was already familiar with some excellent scientific software that was installed on my group's servers, such as Paul Wessel and Walter Smith's Generic Mapping Tools (GMT) and the graphing application Grace, but not the day-to-day software that I needed for my laptop.

The most basic need for people typically is office software. The natural choice for users of Microsoft's Office suites is OpenOffice.org, which essentially performs the same functions. It is able to open and save documents in Office formats or print directly to PDF. I use OpenOffice.org's Impress to prepare conference presentations and lectures, Write for writing papers and Spreadsheet for spreadsheets. However, there are a couple of caveats. First, some types of images are strongly aliased when displayed in slideshow mode in Impress; however, this is easily solved by converting the presentation to PDF. Second, equations created in Word cannot be edited in Write, and vice versa.

The main specialized proprietary applications that I use are the MathWorks' MATLAB (an excellent programming environment that can be installed in Linux) and CorelDRAW (graphical software). The simplest open-source alternative is GNU's Octave, which is in most ways a clone of MATLAB. It is quite easy to use Octave as a drop-in MATLAB replacement, as it uses the same language as MATLAB. With some exceptions, most computational scripts written for MATLAB will run correctly in Octave. The one major exception is graphics. Although MATLAB has an integrated graphical user interface (GUI) and graphics handler, Octave interfaces with several different GUIs and plotting applications. Gnuplot is the default plotter, but it isn't ideal for producing publication-quality graphics. I use the Koctave GUI with Octplot or Grace for plotting (Figure 3); both are pretty good, although only Grace allows you to make changes to a graph once it has been created. MATLAB's main advantage is that it is significantly faster and easier to use. On the other hand, you can install Octave on as many machines as you like, so it may be convenient to use both if you have a MATLAB license.

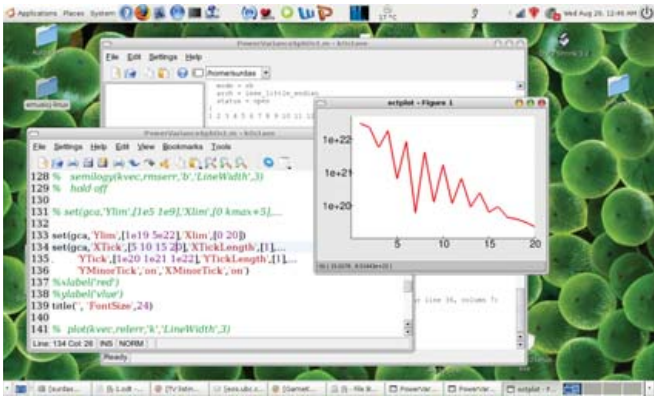


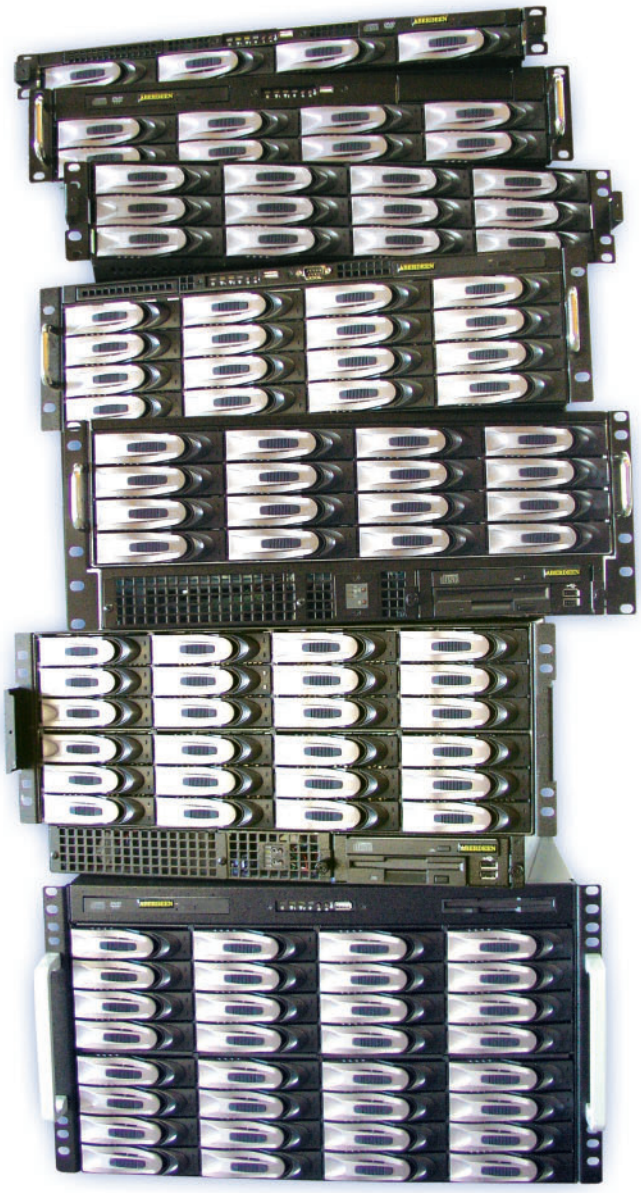
Figure 3. Using Octave with Koctave and Octplot as a MATLAB Replacement

Unfortunately, I didn't find any Linux software that could replace CorelDRAW. However, the GNU Image Manipulation Program (GIMP) is a great tool for image processing. It's very user-friendly and performs many of the functions of Adobe Photoshop or Corel PHOTO-PAINT. Many excellent open-source applications exist for playing music and video that are as good as or better than their proprietary equivalents. If you're using KDE, Amarok does an excellent job of organizing your music and radio stations. If you prefer GNOME (as I do), you'll likely go with Banshee or

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- Linux OS on DOM
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www.aberdeeninc.com/lj021

Exaile. I also use GNOME's Totem for playing DVDs and MPlayer for most other video formats.

If you want to use your laptop to make phone calls when you're on the go, open source is the way to go. Ubuntu comes with the Ekiga softphone built in, and several other open-source and proprietary softphones are available—most free of charge. In addition, the most common VoIP (Voice over IP) protocol, SIP, is open source, allowing you to make free calls to anyone using that protocol. By contrast, Skype users can call only other Skype users for free.

Virtualization

If you still need (or want) to run Windows applications—in my case, CorelDRAW and Word—you have a few options. First, you can create a multiple-boot system, as described above. However, if you use only a few Windows applications, you may be able to run them using CodeWeavers' Wine or CrossOver Office. Wine is free, whereas CrossOver Office is a beefed-up commercial product based on Wine; a license for the Standard version will run you $39.95. They work well for several popular Windows applications, such as Microsoft Office 1997–2003, iTunes and Internet Explorer, but don't count on being able to run your favorite programs.

A third and, in my opinion, more fun option is to install your copy of Windows on a virtual machine using virtualization software, allowing you to run it within Linux. An excellent open-source solution, Fabrice Bellard's QEMU, provides full hardware virtualization. Following the tutorial listed in the Resources for this article, it's quite easy to install QEMU, create a hard disk image and install your copy of Windows (or any other operating system). Once you have the guest operating system running, you can transfer files to and from it by passing in a USB device or mounting the disk as a loopback device (although you will not be able to write to it if it uses the NTFS filesystem). Alternatively, you can set up a network connection between the host and guest OS using TUN/TAP networking and transfer files via FTP. This method also gives you the option of allowing the guest OS access to the Internet, although there are obvious advantages to isolating your Windows install. Here's my QEMU startup script as an example:

```
#!/bin/sh

ARGS="-boot c -kernel-kqemu -net nic,vlan=0 -net
tap,vlan=0,script=/etc/qemu-ifup -m 512 -localtime -cdrom /dev/hdc -usb
-usbdevice host:xxxx:xxxx -std-vga -full-screen xp.img"

exec qemu $ARGS
```

The performance is quite good if you use the kqemu acceleration module, particularly if you have a dual-core processor, but I wouldn't recommend running resource-intensive programs. If you're running on batteries, keep in mind that running a virtual machine consumes a lot of power.

The Linux Edge

What are the advantages of a Linux laptop? The main advantage of Linux in general is the degree of control it gives you over your computer. This is even more important on a laptop, where you have limited resources—particularly with respect to memory and storage. Linux permits a degree of customization that is impossible in any other environment. For example, you can run a stripped-down Arch Linux with the lightweight Fluxbox window manager for a memory- and power-efficient system. Or, if you're plugged in, you can boot into a full-featured Ubuntu system with GNOME or KDE and a powerful composite window manager, such as Novell's Compiz or Beryl, a Compiz fork developed by Quinnstorm (Figure 4). For those who enjoy a little razzle-dazzle, take a look at what these window managers can do on YouTube. My Ubuntu/Arch/Windows setup gives me the flexibility I need to work (or play!) wherever I am. Arch provides a lightning-fast, stripped-down system with reduced power usage, and Ubuntu provides a full-featured, easy-to-use system with an excellent package manager to reduce bloat.

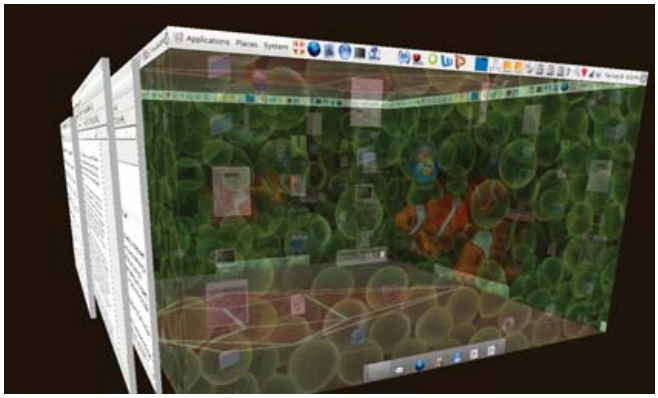


Figure 4. Switching Workspaces Using Beryl

Acknowledgements

I would like to thank Anthony Egan, my system administrator at Washington University, without whom I probably would never have dared to install Linux on my laptop. He helped me with many of the issues mentioned here and was always available to talk Linux.■

P. Surdas Mohit is a postdoctoral fellow at the Institute of Geophysics and Planetary Physics at Scripps Institute of Oceanography and a Visiting Scholar at the University of British Columbia in Vancouver, Canada.

Resources

Linuxant: **www.linuxant.com**

How to Share Firefox and Thunderbird Data between Windows and Linux: **ubuntuforums.org/showthread.php?t=203524**

Arch Linux User-Community Repository: **aur.archlinux.org**

GNU's Octave: **www.gnu.org/software/octave**

CodeWeavers: **www.codeweavers.com**

How to Install QEMU: **https://help.ubuntu.com/community/WindowsXPUnderQemuHowTo**

How to Configure QEMU to Share Your Network Connection: **ubuntuforums.org/showthread.php?t=179472**

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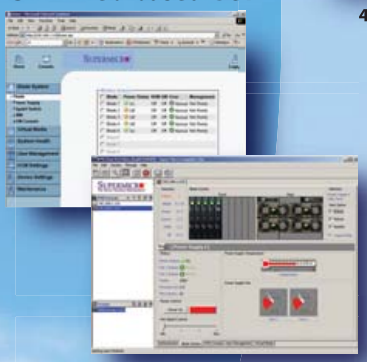


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Interview with Sean Moss-Pultz

Who wants one of those "brickable" or "open" phones when you can have a truly open Linux-based phone? Sean Moss-Pultz on the OpenMoko Project, the Neo1973 and what it really means to be free. Bricks not included.

ADAM M. DUTKO

AD: Please tell us about yourself.

SM-P: I'm from San Diego, California, and I've been living in Taiwan now for about three and a half years. Right now I'm the head of a department inside FIC. FIC is a really large Taiwanese OEM/ODM that builds notebooks and desktops for big global brands, and then, the new thing we are working on is mobile devices. We are working to create the project OpenMoko and turn it into Moko the company. So, once OpenMoko is spun off correctly, I will be the President of that company.

AD: How did you get started with computers?

SM-P: I've been trying to think about this for quite some time. I think I got my first computer...I'm pretty sure it was an 8086...the first x86 processor ever. After that, almost every single PC there was, I've played with it. When I was around 12, I started really taking them apart and then building them. I figured out that you could go buy parts and build your own PC, so I started my own business servicing people down the street and selling them PCs.

AD: So, you were an entrepreneur early on?

SM-P: Yeah.

AD: Did you just network with your friends and family?

SM-P: Yeah, I guess I kind of started that way. My parents, when I was young, would refuse to let me have a TV in the house, but they gave me a computer. So, I always learned how to mess around with computers for that reason.

AD: What moved you from working with desktops to embedded devices?

SM-P: I guess what the easier question is what moved me to Taiwan. While I was here, I just kind of got thrown into mobile devices. I've always messed around with computers, but I've never done what they always call, "Computer Engineering". In school, I studied physics, so when I finished school, I got the itch to travel. To make a really long story short, I had a good friend from graduate school who was Taiwanese, and he said, "Hey you should come out here and check out Taiwan." So I came out here and actually thought it was pretty cool...it was about as far away as you could get from San Diego, and so I figured I might as well come out here.

I started working and I couldn't speak the language, so they said "you're going to be a Software Engineer." Then we started working on mobile phones, and this is where I got started, if that makes sense.

AD: Sure. Can you talk about some mobile phones you've worked on? Or is that still under NDA?

SM-P: Sure, but it's actually somewhat different from the mobile phones we have in the States or in Europe. There's this technology here called PHS. It was started in Japan in about 1996, if I remember correctly. Think of it kind of like a digital cordless phone that's a bit more powerful, and that can roam on both cellular networks and your own home cordless network. In China, because the Chinese government didn't want to run copper wire to all these small villages, they just basically adopted this PHS phone as their "fixed-line phone". So they have 100 million subscribers in China right now for PHS. It was growing really really fast, the market, and this was about three years ago. Of course [the Taiwanese] decided to do a "me too" product—you know, they have it; we should do it too. So I spent way too much time working on a product that ultimately was a pretty big failure, but I learned a lot about the process.

AD: I've read, much like you highlighted, that because there would be so much infrastructure and cost involved in running traditional copper and so forth, that the Chinese made a complete jump to better technology than we have in the States.

SM-P: I think this is a trend you'll see more and more. When you come from behind, you have the luxury of second putting; you can see what the person in front of you did.

AD: Plus, there's probably not a lot of the same restrictions we have, such as intellectual property (IP).

SM-P: There is none. Taiwan is actually, really, I don't want to say strict about IP, but they do follow it. China is basically a free-for-all.

AD: So you have this PHS technology, which I'm assuming is kind of a gap filler. Say you dropped off a supported area, to sort of a hotspot, could you keep talking?

SM-P: Yeah. It's extremely low-power. If you do it right, make the phone correct, the phone will last two or three or four weeks, or something like that, on a single battery charge. It's really cheap too. It's supposed to be a low-cost phone, and it's not really made for roaming.

AD: You said the PHS device didn't really pan out in the marketplace, but you knew someone from graduate school who brought you over there, and who then helped you get into FIC. Is that correct?

SM-P: Basically, the company I started working for was a startup funded by FIC, doing PHS. In Taiwan, or I guess the FIC group, the parent company, also owns one of the operators in Taiwan. So, after we did


neo1973
1973

> "The whole point of free software is that you want people to copy it, and if people don't copy it, if they don't work on it, if they don't contribute to it, it doesn't get better."

the PHS, we were brought back to the "mothership" and started this GSM group. It's the mobile group inside FIC to do GSM phones, and also CDMA phones, but mainly GSM. Now it's called mobility.

AD: Is it called the GSM group within FIC, mobility or something else?
SM-P: Now it's called mobility.

AD: You said FIC is a large OEM/ODM, don't they make a lot of devices for Nokia as well?
SM-P: Not Nokia. FIC as a company is 27 years old. Its core business is all notebook, desktop and consumer electronic devices. It didn't do phones until about two years ago, when we came in.

AD: What moved FIC into the direction of doing a user-modifiable cell phone like the OpenMoko?
SM-P: Oh, well, me kicking and screaming for a long time. No, really, me kicking and screaming for a long time. If you think about it, it's totally...contrary to the core business of this company. My job kind of was shifted to being a product manager, and this was sort of at my own request. When we finished this PHS phone, I thought the technology we did was really cool, but the whole market positioning, the whole design, everything was just wrong, and so that's why it failed, or at least, how I convinced myself of why it failed. I asked them to give me a chance to be a product manager. And, what I thought about were two things: first, what's the device I want (and that was an open phone); and the second was, if we could do it all over again, start from scratch, more or less, with GSM, how would we do it? Well, you need to do it in such a way that you could compete on a global scale, and I think the only way to do that is with free software.

AD: So, you took the PHS model and kind of mapped it on to doing a GSM consumer device, and you are trying to get the community involved with developing the software and hardware?
SM-P: The actual hardware, the actual schematics, are closed. But, we take really, really, really high-res pictures and put them on the Web, so it's about as open as I can possibly get. FIC is still a hardware company, so the idea of open hardware still kind of scares them. But, the open software is okay—internally, they're really warming up to the idea, especially the CEO and Chairman, they've been huge supporters of us.

AD: I was recently in the Freenode #openmoko channel, and someone stated it would be interesting once a Chinese company takes your model and "copycats" the device. The user clarified that question by stating it would be a total win for FIC. What do you think?
SM-P: Yeah. Definitely. In fact, putting on my business and marketing hat, I think the only way you can compete, in this market here, is if you have a product that, if it is copied, it gets better. If they don't copy it, it doesn't get better. The whole point of free software is that you want people to copy it, and if people don't copy it, if they don't work on it, if they don't contribute to it, it doesn't get better.

AD: Can you give us a deeper explanation about what the OpenMoko is? Is it a philosophy? Is it a device and a philosophy?
SM-P: OpenMoko is a platform. Let me just say OpenMoko, Inc., and we'll get back to that later. So, OpenMoko is this platform, and it's more than just this first device we're making. The first device we're making is called the Neo1973. It's kind of a geeky name, so let me just digress for a minute. In 1973, inside Motorola, there was an Engineer by the last name of Cooper, and he made the first cellular call. He basically invented the cellular phone. In Latin, neo means new. So this is like the new phone. It's kind of the idea that you have this industry that has really changed the way the phone works. People now can use the phone anywhere—when you're on the go, when you travel. In a sense, this change from a fixed line to the mobile came at a cost, and this cost is lack of user control—it's lack of the ability to plug this thing in to any network you want to. So, what we think is that when you open up this phone, you create conditions for growth much like you see on the Internet, where you can see all kinds of interesting things coming out of it, not just technologies. In the mobile world, all you see is technologies, MMS, SMS, this IPTV stuff, but then on the Internet, you see technologies sure, but you also see companies. You see huge communities, and you see all these interesting things forming. I think that when you open up the phone, essentially you turn it in to the Internet, where each node of the system, of the network—in this case, each phone—is as important as the next one. Does that make sense?

AD: So the large telecommunications companies, the ones with large fixed infrastructure to derive income, went mobile and when they did, they took the same model of actually having control over all of that and applied it to the mobile devices. This is changing that model, because not only is every device potentially network-independent using the open Atheros AR6k chipset, but each device easily can go provider to provider using a SIM card and GSM. The owner is also in control of the full stack of software, not just the vendor.
SM-P: We actually have these things that we call our "freedom requirements". It's basically that any piece of software that runs inside the Linux kernel...we require that they're free software.

AD: So going back to OpenMoko, Inc., it's going to be a mobile device company? A mobile phone company?
SM-P: We have only one goal. It's a very simple goal. It's to create the world's best open mobile devices. It's everything we're going to do. It's going to be super focused, and the devices we create will be based on free and open-source software. They'll all have a combination of cellular technologies, wireless technologies for Wi-Fi networks and also GPS.

AD: You mentioned the term open source. Now, what does

that mean to FIC, and to you as a developer on the OpenMoko Project?

SM-P: I think the best way to describe it is that to FIC, it levels the playing field. We don't need to have to negotiate the best license to get a better deal than the other Taiwanese OEMs with Microsoft. We just go download the code we want and start working on it. To myself, as a person, independent of FIC, I believe that the core technologies...that we use in our lives, I think that we need to be the ones who are are able to shape these things, to change these things to make them so they are relevant to our own individual needs. This is what "open" does for you. It lets you change these things in the way that you think is correct, in the way that works best for your life. I like to think that the mobile phone is our most immediate form of computing. It's our generation's method of communication. So, an open phone is sort of like democratizing this communication method.

AD: So, it's bringing it down to the people, instead of some large company controlling how you communicate with people.

SM-P: Yeah. Communication was always this social thing; it was never centralized—like, hey, I speak to this person and he or she speaks to you, but the mobile world is like this. So I think that when you have it open, that when you can connect to different networks and when people can even connect peer-to-peer, I think it will be interesting. I'm really curious to see what happens. Honestly, I don't know what will happen.

AD: How many developers are working on the project?

SM-P: At FIC, we have a lot of people working on the hardware and software—it's kind of hard to say, and I can't really talk about too many specifics publicly. Right now, it's about 40 people, if you include both hardware and software. It's not big enough, let me put it that way—I need a lot more people.

AD: What about other open-source developers?

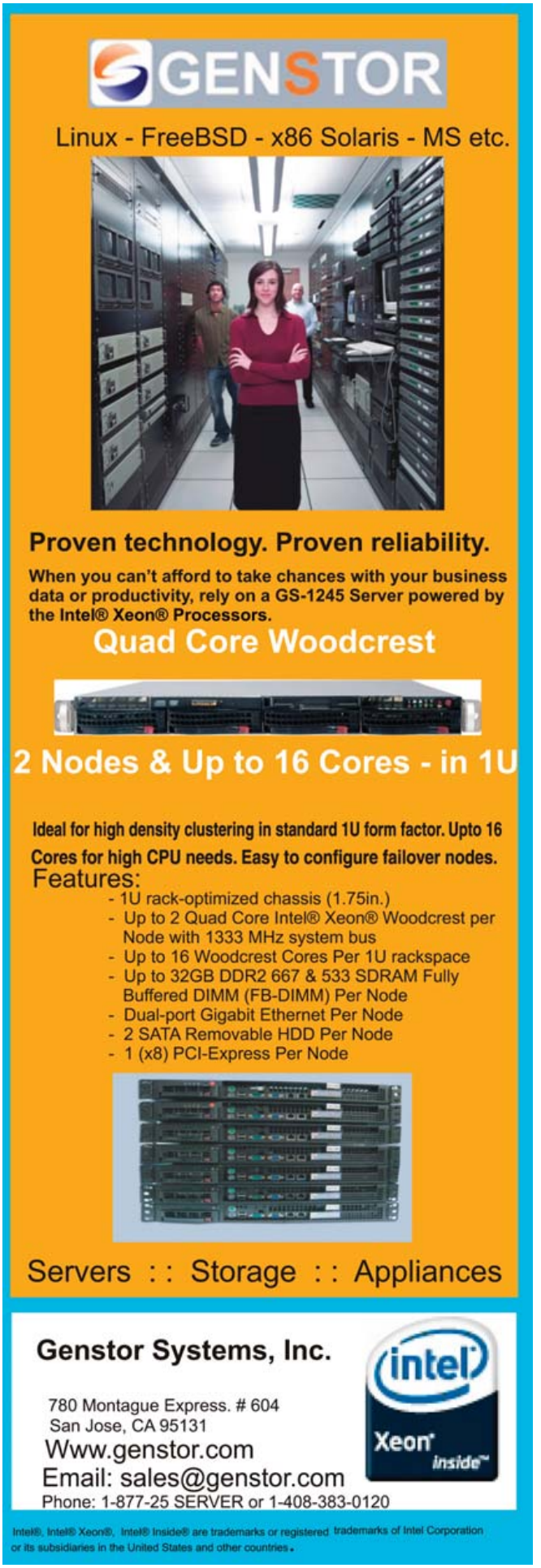
SM-P: We have this community mailing list, which gets a lot of really interesting topics, especially lately, and I think there is something like more than 5,000 people on it. Actively contributing, again it's kind of hard to say, but I think there is a lot, really a lot, and it's growing, growing by the day right now.

AD: Do you have an open-source code repository where people can get commit access?

SM-P: Yes. We have all the things you would expect to see from an open-source project. I have a background, not so much in open-source development, but I've used open source for a long time, but then the people that I went and worked with, and hired, they've been developing Linux, the kernel, one of them since 1992. They absolutely understand every last detail of the free and open-source culture and how to create projects that are done in this style, with this method. So, all the things you'd expect to see, the wiki, the mailing list, source code management, it's all there.

AD: So how does one get involved?

SM-P: It's no different from any other open-source project. If you go to OpenMoko.org, we have all the resources there. You can start reading the mailing lists, and all the bugs, all the features we're starting to implement are all in Bugzilla, right now. You can look on there and see



what needs to be fixed, what needs to be added, and start submitting patches. Then, we give people commit access when we start building up a level of trust—a relationship with them. A couple people, for example, for the calculator application and the RSS-reader application, have commit access. They just started by writing the applications in their free time, and then they submitted them to us.

AD: You just mentioned writing applications. That's a big departure for many phones currently on the market that are completely closed. Do you have an application framework, and is it documented?

SM-P: We do. It's still in the early stages. I have to be honest, right now, we're still in the very early development stages, but it's actually a really good time to get involved, because you can help influence, you can help shape how this thing will mature, and then when end users actually use it, you will have a big hand in how it looks to them. We have a framework that makes it easy to develop basic applications. We're trying to add a lot more stuff to it that handles networks more transparently. We really want to have the notion of each application being able to get its location. Can it get GPS? Can it read the MAC address from the network? Can it read the GSM towers' addresses? It can go through all these different possibilities. We're trying to develop that framework. It's going to take some time, but we definitely have this vision in mind of creating a very easy framework to develop for.

AD: You mentioned a calculator application and an RSS newsreader. Is there also a Web browser and an e-mail application in the works?

SM-P: Yes. We were selected for the Google Summer of Code, and one of the guys is working on WebKit, so we'll have a browser really soon. I've seen shots of the rendering working. The e-mail stuff we're actually really behind on, but we're starting to work on that—we're cranking on it. We went with WebKit just because it was so small and so light and very, very fast. It should support most of the Web 2.0 stuff you would want to see.

AD: What are some cool ideas that will differentiate OpenMoko from other devices on the market, other than being an open phone platform?

SM-P: Okay, I'll give you two. The first is an idea that came up a couple of weeks ago on the e-mail list that I thought was really interesting. So, you have a To-Do list basically, and then the To-Do lists are location-based. So, you have all these items—when I go to the supermarket, they remind me, buy this, buy that, buy that—and I think that was really cool. It's so simple, but these are the kinds of things that will make our lives easier. We even have a really, really high-performance GPS chipset in our device, so it will know its location too for that reason. The GPS network is totally public, and it also has assisted GPS. The way the assisted GPS part works is it downloads the satellite information from the Internet, and that one, FIC as a company has to pay for that, but you get it for free. But, if you want the pure, standard GPS, that's always free—totally free.

AD: The Neo1973 is a great device, but then again, I also write code. What about my parents and grandparents, and people who are not technologically savvy? Will the device be just as usable as others on the market?

SM-P: Okay, so if I had to step back and put on my prediction hat, if you look at the Internet right now, all the core technologies that have driven this, all the Web sites you look at right now, almost all the e-mail you receive, these are all based upon existing free and open-source software. FOSS, within a time period that most people can't even begin to imagine, can overtake a proprietary competitor, and it can dominate. So I think the answer is absolutely, yes, this will be a device that will completely change the way people think about phones, but I think we have a little while to get there. I have no doubt we'll get there, but it will be at least six months before we get there.

AD: So, you think the device's general release will be fall 2007, or maybe early winter or spring 2008?

SM-P: We do all product development in three phases. In phase zero, we give it to the super geeks, who are really, really, high-profile FOSS developers. Phase one is where we just went a couple weeks ago—where we sell the device as a developer edition. It's not to be used as a day-to-day phone, but you still can do all kinds of cool development work on it, and that's now. And then, in October 2007, we have it to where it will be called an end-user device, but let me really clarify what I mean by end user. At that point, I think it's still going to be a very technically savvy person. It will be someone who is kind of a power user at that point. In quarter one, spring of next year, I think that's the point when we'll start seeing a critical mass of applications—some really interesting new ones coming out. We do have a package manager that will allow you to install applications graphically, and that will be really easy to use. That's kind of our entrance into the mainstream market.

AD: What package manager do you use?

SM-P: It's very similar to Debian's apt-get; it's called ipk. It's based on OpenEmbedded. We use OpenEmbedded to build the whole distribution of OpenMoko. When you use that—we get ipk for free, basically—the exact build system that we use to build the images is also open source, of course. You can download that.

AD: Is it in the master makefile for OpenEmbedded?

SM-P: We have our own OpenEmbedded tree. We're trying to get it merged back upstream, but there was a whole bunch of development on the trunk, so we ended up just doing our own temporary branch....Our lead framework and application architect is one of the original founders of OpenEmbedded, so one of his goals is to get it back in there for sure.

AD: When will it be available in stores?

SM-P: We were going to start selling a version of this phone in October 2007—I think at that point, it will be ready for a technical user. [As far as] how much longer it takes before it transitions to the typical end user, like my mom or dad, we will keep selling it and play that by ear. My gut tells me something like February or March 2008.

AD: So, what's the gimmick? Will it be tied to a provider like AT&T where you have to sign a contract for three years?

SM-P: Yeah, we're going to sell it locked down to AT&T's network [laughs]. No. No. No. It will always be an unlocked phone. We're going to sell it from OpenMoko.com direct. Right now, we're talking with a number of carriers, and we're probably going to pick one

carrier. Not to do some sort of locked-down exclusive thing, that's not the point, it's to get into a carrier who will help us educate the end user as to why an open phone is this incredibly cool thing. I mean, it really needs a process. We really need to talk with people to educate them about what their phones could potentially do.

AD: Are you going to start heavily marketing it in Taiwan first, or are you going to rely more on the Internet? Are you going to specify certain areas of the world you want to market it in first?

SM-P: Our plan going into next year is mainly grass-roots marketing. Because of where we are located geographically, it makes a lot of sense for us to target Asia. For the first half of this year, we've been almost exclusively just doing Europe and North America. Mainly because that's just kind of the culture where most of us are from and we understand that better. Lately, I've been really building up this team internally and finding a lot of talent in Taiwan and China. So, starting this month, we are going to go in and try to find good developers—really start to promote in Asia. Still from this grass-roots-type standpoint, from really bottom-up marketing, not a top-down blanket with an ad campaign.

AD: Is there anything else I might have left out?

SM-P: Yes. We definitely need people to get involved from the educational standpoint. I think if you look at this device, where it has the potential to make the biggest impact is in schools, in learning. If you're a computer science student and you want to study operating systems, you want to study software development, I personally think the mobile phone is the PC of the future. It will leapfrog the PC in a lot of these developing markets. I think there is no better time to get involved, and really, OpenMoko is the right platform to get involved with, because it's all based on FOSS. The things you work on can transfer to the desktop and vice versa, so that's why I think it's a really great opportunity, and we'd love help. We'd love people to e-mail us, get on our mailing list, talk with us about how we can promote this in universities and how we can promote it in academic settings. I think this is where the real, first, interesting usage scenarios will come out....It's these things that will inspire whatever the next phone is. If you kind of step back and look at this, our goal with OpenMoko was not to create a phone better than the iPhone. I mean, I don't even really care about that to tell you the truth. It's not to make a user interface more refined than Nokia. It's basically to change the way the phone works; it's to change the way it operates. If you look at the mobile phone, it has the processing power of a computer, say, three or four years ago, maybe five years ago. Especially when you start having it be able to connect to networks, you have this device that's incredibly powerful, but because it's been closed, people haven't been able to access that. It's been very centralized as far as what you can and cannot do to it. So, I think people who understand socially open technologies and architecture, and these are very much university students, I think they'll get it right away and start playing with it and come up with new ideas that will be really attractive.

AD: Thank you very much for talking with us.

SM-P: It's really my pleasure.■

Adam M. Dutko is a Systems Administrator for a Fortune 500, maintains the mrxvt and astyle packages for Fedora, brews beer, programs an electronic radio show at 89.3 WCSB called "Machine Code" and works on Wireless Sensor Networks at the Cleveland State University Software Engineering Lab. He currently lives in Lakewood, Ohio, with his wonderful wife, two dogs and two cats. You can read more about him at littlehat.homelinux.org:8000.

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Portable Hard Disk Recorder How-To

Use an old laptop to build a multitrack hard disk recorder.

DAN SAWYER

Podcasting is great. More and more people have discovered Audacity to record their podcasts, and in many ways it's ideal. It's like a toe in the shallow end of the recording and producing pool. With a podcast, you rarely need more than a mono channel—maybe a stereo setup if you're recording with someone else in the studio. But, when you get your feet wet with basic dialogue podcasting, it's hard to stop.

After all, there are so many things in the world worth recording and podcasting. There are podcast novels, such as those put out by the folks at **podiobooks.com**, and a good production can run into dozens of tracks between sound effects, guest voices, music and layering.

If you've gone that far, why not go the rest of the way with a full-cast radio drama? Even if you aren't a writer, plenty of plays in the public domain work very well for audio. If you're of a more musical bent, you could set up a recording session for your kid's garage band. However, once you get into doing complex live audio, such as recording full-cast radio dramas, concerts or stage plays, you're going to need more than Audacity. You're going to need a full-fledged portable recording studio.

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Selecting the Hardware

To record a moderate-sized stage play, for example, your recording rig must capture multiple tracks simultaneously and independently while keeping the separate streams in sync. There's nothing quite so stressful as coming home from an excellent performance riding the mixing board to discover that, despite what you were hearing in your headphones, you've inadvertently created phase cancellation in your mixdown with your microphone placement. The data you don't have on your tape or hard drive is data lost forever—data that wouldn't have been lost if the eight-mic zone system had run to a multitrack recorder instead of a stereo mixdown. If you had the individual tracks, you could control for phase and positioning problems, sweeten the mix and even create a surround-sound environment. But, with all of the mics mixed down to stereo, what you hear is probably the best you'll ever get.

Moving from simple stereo recordings on Audacity to doing sophistocated multitrack recordings and mixes is, thankfully, a natural next step on Linux, but it requires some initial cash outlay. First, it's off to the great electronics mall to grab the appropriate hardware to build your studio. Resist your urge to indulge in one of the latest gamer's sound cards; they look sexy, but you're never going to get them to record in anything better than stereo. No, for our purposes, you'll want a good Pro Audio card that's well supported. It's not a cheap move, but for about $500 you can choose from a good range of interfaces that are exceptionally well supported. Of course, you won't want to chuck the sound card your computer already has; a Pro Audio card is designed to interface with mixing boards, digital audio devices and public-address systems—it may not even include a plug for your speakers. For our purposes here, its central feature is that it pipes multiple simultaneous nonmultiplexed streams of audio to your computer, often including MIDI.

It's one thing to build a multitrack hard disk recorder out of your desktop computer—the choice of hardware for your interfaces is embarrassingly extensive, the price range quite broad, and there is far more Linux support than you'd expect in terms of user community. But, unless your home recording studio is both uncommonly large and very well soundproofed, you may have some problems with a desktop HDR. Who wants to lug a desktop computer and monitor around in order to do field recording? If you had a spare $1,500 you could pick up a multitrack appliance, such as the ones made by Alesis and available at fashionable Guitar Centers everywhere, but why bother? You'd still need the Pro Audio card in your desktop to pipe the data back into the computer for mixing, so the total cash outlay is more than $2,000—much too large for even a dedicated hobbyist.

But have faith, all is not lost! In my case, I needed a multitrack portable recording rig to do client site recording of stage shows and panel discussions, and because of the variety of voices and the prevalence of shoddy mic techniques in the world, I needed to preserve the option of postproduction in each individual audio track. I looked into the commercial HDRs, particularly the Alesis models, as I have previously used Alesis' ADAT tape-based system extensively. The advantage of these devices is that you turn them on and they just work—they're firmware-controlled and they operate in hard real time, which is an absolute must for multitrack recording. Even so, in the end, they were not worth the money. Their capabilities are too limited for my needs—most are limited to 48KHz sample rates, which is fine for dialogue, but far too low for recording sound effects, complex movement in a space or music—the 48KHz

sample rate simply can't capture the fine high-end detail and phase information that make such sounds distinct (explaining the audiological reasons behind this is beyond the scope of this article, but a quick read on the basics of acoustical sampling will give you the background you need). I needed a better solution.

Fortunately, I have an old laptop lying around, and Linux—unlike some other popular operating systems I could name—has real-time hardware preemption, which is essential if one wants to build a hard disk recorder. A laptop, of course, will not accept PCI or PCI Express cards, so the choice of Pro Audio interfaces is limited to the external—something that can plug in either to the CardBus slot or the USB or FireWire port.

The list of compatible external audio interfaces is far shorter than the list of internal cards available for desktops, but it's still long enough to require a lot of research. I actually do have an old Swissonics USB Studio D on my rack, which is nicely supported by ALSA and normally sits connected to my desktop HDR station, but it's too big and draws too much power to lug around to remote locations where I might have to run off my car battery.

For my purposes, I needed something around $600, with enough inputs that I could mic a stage play—eight analog inputs, minimum. This automatically culled out most of the FireWire-based interfaces. Even though the FireWire boxes from Presonus can draw all their power from the FireWire bus and let your interface run off the laptop battery—a big plus—the boxes in my price range tend to be limited to four or six tracks. So, on the advice of Ardour Project maintainer Paul Davis (**www.ardour.org**), I checked out the RME Hammerfall HDSP Multiface 2, which is a CardBus-based device with a very nice external breakout box. It helps that its Linux drivers are written and maintained by Davis, who is no mean slouch when it comes to writing tight code. It also helps that I've got one of RME's cards in my desktop HDR, so I knew they were likely to work handsomely. RME's mixing and control panel software for the HDSP is every inch as professional and easy to use as its Windows and Macintosh analogs.

After plugging this interface in to my laptop and configuring it properly, I have a multitrack hard disk recorder that can simultaneously record 24 tracks at a maximum sample rate of 96KHz, well above the maximum available sample rate on far more expensive commercial HDRs, with more available input tracks.



Figure 1. hdspmixer Utility

Distribution Considerations

As mentioned previously, multitrack audio recording ideally requires real-time access to the hardware, but this support is not built in to the kernel by default on most Linux distributions. It's an option that must be enabled at compile time, or, if you're running an older kernel, must be hand-patched into the source before compiling. Although I have no problem recompiling my kernel for a good cause, it's not something I like doing for the sake of pure amusement.

Fortunately, a number of distributions are on the market, geared particularly for multimedia production, that come with real-time priority enabled, with the distribution binaries built with all the architecture-specific and real-time optimizations turned on. Planet CCRMA (Fedora-based), DeMuDi, Ubuntu Studio and 64 Studio (all Debian-based) all come with things set up this way, and if you're building a field recorder from scratch or don't mind re-installing the operating system, they are all excellent starting points for your system. Although I have used all of them and find them all quite capable, I ultimately chose Ubuntu Studio for the sake of consistency with the rest of my platforms—I run Ubuntu flavors on most of my workstations, and even though it's well tuned for real-time use, Ubuntu Studio is more of a general-purpose distribution than is my other favorite, 64 Studio.

Hardware Configuration

Ubuntu Studio is currently in the Debian Feisty iteration, which presents a problem when working with the Multiface 2, as the Ubuntu ALSA version included doesn't

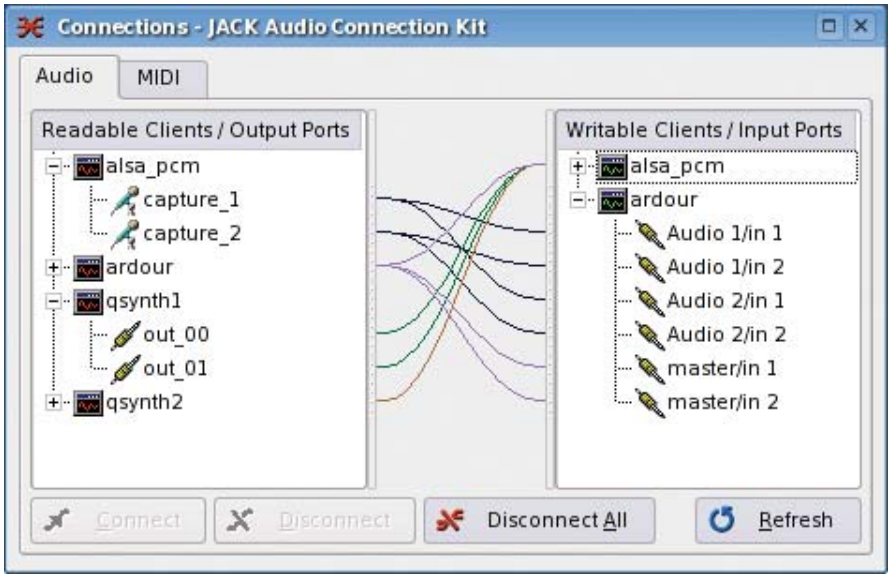


Figure 2. The patchbay is used for routing sound from the hardware into the applications, from one application to another, and then back out to hardware outputs.



Figure 3. Ardour



Figure 4. Ardour Up and Running

contain the correct firmware to activate the hardware. To remedy this, however, a two-pronged attack is required. First off, the ALSA firmware loader, which is not installed by default, needs to be loaded—a task easily done with apt-get. Once that's done, loading the firmware still fails because of the bug in the bundled ALSA version. Heading over to **alsa-project.org** and downloading, building and installing the v.1.1.4 or better firmware fixes this problem neatly. Once that's done, restart the computer. So long as the rest of the default packages are installed (which include particularly all the HDSP tools), the system should recognize the interface automagically.

To test it, open the hdspmixer utility (Figure 1), plug in a microphone or instrument, and do a levels test. Keep this mixer open, as it is your primary first-level control to govern what's coming into your system.

JACK

Now that the hardware is up and running, it's time to get the software whipped into shape. Pro Audio production on Linux is handled entirely through the JACK Audio Connection Kit, which allows software to access the hardware in real time through the real-time-enabled kernel. On the studio distributions, this software is installed by default, although if you intend to use the latest-and-greatest multitrack recording software we'll examine in a moment, you need to upgrade to a later version of JACK than is currently included in Ubuntu Studio.

To start JACK from the command line, enter `jackd -R -d alsa -d hw:1` (hw:1 denotes the second sound card in your system, which will almost always be correct when you're dealing with a laptop, as it has a built-in sound card). Once that's done, start up QJACKCtl or another one of the graphical patchbay clients—you'll need it (Figure 2).

Ardour

When it comes to multitrack recording on Linux, one project shines above and beyond all the other audio recording software available for the platform. That project, Ardour, is maintained by Paul Davis and is unabashedly geared for professional audio engineers. Like Blender, which has a naked aim to be a free professional 3-D finishing system for the masses and is designed with professionals in mind, so too is Ardour aiming squarely for audio professionals, with an interface design

Some Problems with Digital Audio

As you go about your recording, you're going to discover some of the limits of digital recording, such as the fact that current technology doesn't allow for sample rates high enough to reproduce cymbals and other sounds with high, clear treble accurately—sounds you won't run into when recording voices, but you will encounter in music and sound effects. To better understand how digital sampling works, and how you can use sound reinforcement and acoustic techniques to overcome some of those limitations, pick up the *Yamaha Sound Reinforcement Handbook*. It will help you understand how audio reinforcement works and how to compensate for such problems.

borrowed from programs like ProTools and then tweaked with an eye toward improving upon it. As such, its interface is daunting and obtuse for the newbie, but it operates with great efficiency and transparency once you get acclimated (Figure 3).

The version of Ardour that ships with the current studio distributions at the time of this writing is version 0.99, which lags behind the current release, now comfortably into 2.0 territory. For most purposes, 0.99 is fine, though some of the improvements in version 2.0 are ones you'll want to take advantage of eventually. If you want to get up and running in the quickest order, start the version that comes with your distro, connect the HDSP patchbay outputs to the Ardour inputs, and you're up and running (Figure 4).

If, on the other hand, you want to use Ardour 2.0, you need to do the requisite download/compile/install routine for both the new version of JACK and for Ardour, and you will not have to start JACK or QJACKCtl before starting Ardour—the new version of Ardour has a JACK control interface built in. In either case, when you're up and running to this point, you're ready to rock and roll. Plug your microphones or instruments to your breakout box, and begin recording. But, keep the manual wiki handy until you get familiar with things!

Final Thoughts

Three years ago, this project would have been a royal pain in the hind end. Although the Multiface has always been Linux-compatible, once upon a time, doing real-time audio on any hardware required a lot of fancy command-line tricks and kernel recompilation. The plethora of studio distributions in the last couple years has radically changed the process and has brought the most powerful parts of the Linux multimedia subsystem into the reach of people who are power users and hobbyists, rather than remaining in the domain of kernel hackers. Thanks to the power of Linux and open-source software, for the cost of an old laptop and a new audio interface, you own a proper, full-featured, multitrack digital audio field recorder. Go forth, record, edit, create and compress!■

Dan Sawyer is the founder of ArtisticWhispers Productions (www.artisticwhispers.com), a small audio/video studio in the San Francisco Bay Area. He has been an enthusiastic advocate for free and open-source software since the late 1990s, when he founded the Blenderwars filmmaking community (www.blenderwars.com). Current projects include the independent SF feature *Hunting Kestral* and *The Sophia Project*, a fine-art photography book centering on strong women in myth.

Resources

Laptop-compatible Pro Audio interface support is spotty and hard to find accurate information on, but an excellent place to start is the FFADO Project at **www.ffado.org**.

The other place for good information is the ALSA Project hardware database at **www.alsa-project.org**.

For more information about tweaking the RME Multiface 2, see the HDSP How-To at **pd.klingt.org/files/hdsp-howto.html**.



Ye Old Laptop as a Server

Don't throw away that old laptop; use it as a mobile VoIP and Web server.

JOSEPH QUIGLEY

Resourceful people can use an old desktop as a server of some sort, but they also may have an old laptop around collecting dust. Although most of today's desktop environment software runs too slowly on these older laptops, you may not want to get rid of yours yet. These cast-offs easily can be transformed not only into a low-power server, but also into a mobile VoIP and Web server.

Let's look a three Linux distros with this in mind and test two different Web servers. The Ye Old Laptop used in this article is a Dell Latitude with a 1.0GHz Intel Pentium III Mobile CPU and 256MB of RAM. Keep in mind that Web 2.0 software may be too much for these old cast-offs. So, if you need to serve the latest-and-greatest flashy content, you're better off buying a new desktop computer. The server configuration I used and tested on every Linux distribution is Apache 1.3.34, Lighttpd 1.4.13, PHP 5 and MySQL Server 5.

Table 1. Performance Differences between Apache 1.3 and Lighttpd 1.4.13 on Xubuntu with a 5KB File

Ten clients, ten hits/second, 5KB file	Apache 1.3	Lighttpd 1.4.13
Time elapsed	9 secs	8 secs
Data transferred	0.2MB	0.35MB
Server response time	0.06 secs	0.00 sec
Transaction rate	11.00 trans/sec	12.5 trans/sec
Throughput	0.02MB/sec	0.04MB/sec
Concurrency	0.7	0.02
Longest transaction	3.00 secs	0.04 secs
Shortest transaction	0.00 secs	0.00 secs

Xubuntu 7.04

Xubuntu is an official Ubuntu distribution for old or slow systems. The main difference between it and Ubuntu is that Xubuntu uses the Xfce window manager instead of GNOME. An X-less Ubuntu or Kubuntu installation should have the same performance results as an X-less Xubuntu. With X running, Xubuntu requires at least 128MB of RAM, but the minimum requirements for the Xubuntu Alternate CD without X are 64MB of RAM. It uses the Ubuntu repositories, which are filled with programs that satisfy nearly every system administrator's needs. I installed Apache 1.3 and Lighttpd 1.4, MySQL Server 5 and PHP 5 with `apt-get install apache lighttpd` and `apt-get install mysql-server-5.0 php5`. For some reason, I had to install Apache 2.0 (and all its dependencies) to get PHP to work with Apache 1.3. After I got it working, I then uninstalled Apache 2.0.

After configuring Apache and Lighttpd, I stress-tested the Web server over a 100Mb Ethernet connection with Siege, a benchmarking and HTTP regression-testing utility. It is designed to let Web developers measure the performance of both their code and their servers to see how well the server functions on the Internet under a heavy load. Siege supports basic authentication, the HTTP and HTTPS protocols, and even cookies. This utility allows system administrators to hit their Web server with both a concurrent and configurable number of simulated users.

I generated a 5KB file with dd and ran a stress test with `siege 192.168.1.179/5kb -c10 -r10` on a fairly new computer, simulating ten clients refreshing ten times each second (a fairly heavy load). To improve results, I turned off all unneeded services, including Xorg, Samba, the FTP server and the IRC server. If you run Siege with the -b command-line argument, it runs the test without any delay for throughput benchmarking. This means that the server gets all the hits at once (but that isn't a very realistic scenario). Without the -b flag, Siege invokes each simulated user with a delay of at least one second. Table 1 shows the performance differences between Apache 1.3 and Lighttpd 1.4.13.

The tests performed on Xubuntu 7.04 (Table 1) reveal that the transaction rate is high, and the shortest transfer time is about a millisecond or less. (Siege can't calculate anything below a millisecond.) This is mainly because my network consists of only 20 feet of cable. Depending on your connection, testing over the Internet will show a greater latency than over a local network. According to the Siege man page, concurrency is the average number of simultaneous connections. When the number rises, the server performance decreases, especially on slower hardware.

The tests performed on the 1MB file (Table 2) show that under a heavy load, Lighttpd 1.4.13 performs the best with smaller files (such as blog posts without any pictures). Performance, however, is still higher than Apache with 5KB files. Interestingly, the heavier the load, the better Apache performed. Results from tests on 5MB files under a very heavy load of 50 clients at ten connections per second showed a 0.1 second higher response time and a 0.1MB/sec higher throughput than Lighttpd. Lighttpd still had shorter transaction times that were four seconds less than Apache though.

On Xubuntu, Lighttpd is the fastest performing server for static documents, although Apache follows close behind. For best results in Xubuntu, turn off all unneeded services, so

Table 2. Performance Differences between Apache 1.3 and Lighttpd 1.4.13 on Xubuntu with a 1MB File

Ten clients, ten hits/second, 1MB file	Apache 1.3	Lighttpd 1.4.13
Time elapsed	12 secs	12 secs
Data transferred	108.41MB	108.40MB
Server response time	0.5 secs	0.4 secs
Transaction rate	8.3 trans/sec	8.2 trans/sec
Throughput	9.0MB/sec	8.9MB/sec
Concurrency	4.3	3.5
Longest transaction	1.30 secs	0.75 secs
Shortest transaction	0.1 secs	0.1 secs

Table 3. Performance Differences between Apache 1.3 and Lighttpd 1.4.13 on Vector Linux with a 5KB File

Ten clients, ten hits/second, 5KB file	Apache 1.3	Lighttpd 1.4.13
Time elapsed	9 secs	7 secs
Data transferred	0.49MB	0.49MB
Server response time	0.09 secs	0.00 secs
Transaction rate	11 trans/sec	14.2 trans/sec
Throughput	0.05MB/sec	0.07MB/sec
Concurrency	1.00	0.02
Longest transaction	3.00 secs	0.01 secs
Shortest transaction	0.00 secs	0.00 secs

that if the server gets a heavy load, it will have a few more resources to improve speed. I found Xubuntu to be quite fast and easy to get running, but there are other distros to consider, such as Vector Linux.

Vector Linux 5.8

Vector Linux is another distro tuned for slower systems. It is based on Slackware 11, but unlike Slackware, Vector strives to retain legacy drivers for very old hardware. Its forum actively supports users of equipment that is considered to be outdated. It is even used for software development and Web serving, even though the distribution's focus is on the desktop environment.

Vector Linux comes with Slapt-get, an apt-like package manager for Slackware-based systems, by default. It is quite compatible with most Slackware packages on **linuxpackages.net**, so installing Web server software is quite straightforward. I couldn't get a package list from Linux Packages (at the time of this writing), so I gave up and compiled Apache, Lighttpd, PHP and MySQL from scratch. I copied over the Apache and

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Table 4. Performance Differences between Apache 1.3 and Lighttpd 1.4.13 on Vector Linux with a 1MB File

Ten clients, ten hits/second, 1MB file	Apache 1.3	Lighttpd 1.4.13
Time elapsed	11 secs	10 secs
Data transferred	97.67MB	97.67MB
Server response time	0.4 secs	0.3 secs
Transaction rate	9.1 trans/sec	10 trans/sec
Throughput	8.9MB/sec	9.7MB/sec
Concurrency	3.59	3.21
Longest transaction	0.63 secs	0.65 secs
Shortest transaction	0.08 secs	0.08 secs

Table 5. Performance Differences between Apache 1.3 and Lighttpd 1.4.13 on DSL with a 5KB File

Ten clients, ten hits/second, 5KB file	Apache 1.3	Lighttpd 1.4.13
Time elapsed	7 secs	10 secs
Data transferred	0.49MB	0.49MB
Server response time	0.00 secs	0.09 secs
Transaction rate	14.2 trans/sec	10 trans/sec
Throughput	0.07MB/sec	0.05MB/sec
Concurrency	0.02	0.90
Longest transaction	0.01 secs	3.00 secs
Shortest transaction	0.00 secs	0.00 secs

Lighttpd configuration files from Xubuntu and made sure everything was working. Then, I fired up Siege and stress-tested it.

Similar to the results with Xubuntu, Lighttpd is a clear leader in speed on Vector Linux as well (Table 3). On Vector Linux, Lighttpd has a noticeably higher transaction rate than Apache, and Apache's longest transaction is practically three seconds slower than Lighttpd's! Throughput is just a tiny bit greater with Lighttpd than with Apache, and the concurrency is shockingly low. This speed gap closes when Lighttpd is presented with a 1MB file. Just like working with Xubuntu, you should turn off any unneeded services and even cron jobs in Vector Linux for optimal performance.

Lighttpd on Vector Linux is the fastest performing server for static documents (Table 4). Apache follows with good results. Results from tests on 5MB files also under a considerably heavy load of 50 clients at ten connections per second showed that Apache had an average response time about 150 milliseconds faster than Lighttpd. Lighttpd and Apache had nearly equal transaction rates and throughput, but Lighttpd's concurrency was higher than Apache's. Interestingly, Lighttpd's longest transaction time was a full ten seconds shorter than Apache's!

Slackware is often known for its almost legendary server qualities, and it appears that Vector Linux measures up to them. What happens though, when you go even smaller—as small as the 50MB Damn Small Linux?

Damn Small Linux 3.3

Damn Small Linux (DSL) is known for its small size and for running well on slower systems. It also has the apt package manager. With the right apt repository, you can practically turn DSL into a full-fledged distro! It was designed to run on very old hardware, including processors such as the 386, 486, Pentium, Pentium II, Pentium III and the older AMD equivalents. Unlike Vector Linux and Xubuntu, DSL uses the "classic" 2.4 Linux kernel and BusyBox, rather than the 2.6 kernel and the GNU utilities. Like Knoppix, it is designed to run off a Live CD (or USB thumbdrive), but it serves as an excellent desktop operating system too—if you don't mind using older versions of your frequently used software.

DSL is somewhat crippled for anything but Web browsing and music playing. To use DSL as a server OS, you will need to install the GNU utilities by selecting Apps→Tools→Upgrade to GNU Utils in the System menu. This will make the DSL system more fully GNU-compatible. If you plan to use apt, you need to click on Apps→Tools→Enable Apt in the System menu. Now that the GNU utilities are installed, you can install Apache or Lighttpd. I recommend compiling everything—PHP, MySQL and the http server—from scratch. Although this takes some time and effort, it is far less complex than trying to get everything working correctly with apt or MyDSL (Damn Small Linux's own spartan package system). By compiling the Web software from source, you have complete feature control as well.

For those who don't need or want Apache 1.3, the XAMPP Project has a completely configured and working standalone Apache 2, MySQL and PHP binary package that can install anywhere on the system.

The speed difference between Apache and Lighttpd is quite noticeable (Table 5); Apache is clearly the faster of the two. I used the Apache package in the MyDSL package manager though, which could be optimized for older systems. Interestingly, Apache had a higher transaction rate than Lighttpd did. It

Table 6. Performance Differences between Apache 1.3 and Lighttpd 1.4.13 on DSL with a 1MB File

Ten clients, ten hits/second, 1MB file	Apache 1.3	Lighttpd 1.4.13
Time elapsed	11.7 secs	10.8 secs
Data transferred	97.66MB	97.66MB
Server response time	0.34 secs	0.35 secs
Transaction rate	8.5 trans/sec	9.3 trans/sec
Throughput	8.3MB/sec	9MB/sec
Concurrency	2.9	3.3
Longest transaction	0.70 secs	0.65 secs
Shortest transaction	0.08 secs	0.08 secs

also had quite a low concurrency. Although Apache is noticeably faster than Lighttpd, the hardware constraints of the laptop make any Web server lousy at anything but small files under a heavy load. However, it could serve small blogs or PHP, Perl, Ruby and Python scripts under a medium load without getting too overloaded.

Although it may seem like Lighttpd is slacking off on the first test, when it has to pull a load, it does it efficiently.

Test results show (Table 6) that Lighttpd quickly regained its customary speed over Apache. Lighttpd's average response time is only a fraction faster than Apache's, but the transaction rate is almost a full megabyte per second more than Apache's. Lighttpd, however, has a higher concurrency, but that didn't pose a problem when I ran a test with 50 clients connecting ten times a second, as Lighttpd was still faster. Running this test on a 5MB file returned very disappointing results. Apache had the lowest of the longest transaction times but was otherwise the same as Lighttpd in throughput and transaction rates.

Overall, DSL is the smallest of the three distros tested in this article. When fleshed out with Apache/Lighttpd, GNU and other server utilities, the disk space used is less than 100MB. In general, Lighttpd and Apache on Damn Small Linux tie in practically every aspect. You will notice some minor speed improvements with X turned off, and although there aren't many, you still may want to turn off all unneeded services. In these days of broadband, even a quarter of a second can be a quarter second too slow. Damn Small Linux may seem like a strange distribution to use as a server OS, but there is no real reason why it can't be used as one—it's just one of the few actively developed distros that uses the 2.4 Linux. Like all distros, DSL needs to be tweaked so that you can get the most out of it.

Getting the Most out of the Server

Configuration is everything in a server. To milk some more speed from your server, you will want to configure it to your needs. Turn off all server modules you don't plan to use. Apache limits the number of users that can connect to the server at one time to around 5,000 clients. For a laptop with such limited capacities as the one used in this article, you most likely will want to lower this to 500–1,000 clients, depending on what kind of content you will be serving. For best results, eliminate unneeded features from the SQL Server and languages such as PHP, Python, Ruby or Perl, by recompiling from source, if need be.

SQL Servers can be resource hogs, so if



you want to extract the most speed from your computer, you should configure the SQL Server to your needs. Both PostgreSQL and MySQL have pages on speed optimization on their Web sites (see Resources). In addition to functioning as Web servers, old laptops are great Voice-over-IP servers as well.

TeamSpeak

TeamSpeak is proprietary VoIP software that works similarly to a telephone conference call. Like IRC, users connect to a TeamSpeak server and join different chat channels. Its primary target audience is gamers, but it can be used for meetings and discussions or just to chat. Unlike Asterisk, TeamSpeak was designed for networked computer-to-computer voice calls, and it does not interact with the SIP protocol or any type of phone. It has similarities to IRC, such as channel administrators, protected channels and voiced channels. TeamSpeak can give various abilities and privileges to clients, ranging from server administrators who control the way the server or channel operates to anonymous users who have no privileges and can only chat.

The TeamSpeak Web site explains that the current game communication services, such as Roger Wilco or Microsoft's GameVoice, did not fulfill the creators' needs. Some of the primary problems with these services are the lack of Linux compatibility and the issues with high-bandwidth utilization and routers. The TeamSpeak server, however, runs with surprisingly low system requirements—a minimum of 32MB of RAM and a 100MHz CPU. With TeamSpeak on a laptop, you can have a LAN party and move from house to house to improve team communication while playing games such as *Warsow*, *Tremulous* or even console games. Another possibility is to meet with a few people at someone's house and have a meeting over the Internet with a few others around the planet.

Installing TeamSpeak on Xubuntu, Vector Linux and DSL was a piece of cake. I downloaded the server from its Web site, but ran into some dependency problems. I then stumbled across a how-to on the site that gave me a link to a version on an FTP site and included dependencies.

Which Distribution and Server Is Best?

In the Open Source world, myriad choices exist. The tests performed in this article cover different file sizes on two different Web servers running on three different Linux distributions.

The winner for the 1MB file tests is Lighttpd on Vector Linux. The transaction rate was an average of ten transactions per second and a throughput of 9.7MB per second. Damn Small Linux came in second place with an average of 9.3 transactions per second and a throughput of 9MB per seconds.

The competition for the 5KB file resulted in a tie between Apache on DSL and Lighttpd on Vector Linux. Both Lighttpd and Apache had average transaction rates of 14.2 transactions per second on Vector Linux and DSL, respectively. Throughput was the same for Apache on DSL as it was for Lighttpd on Vector Linux, weighing in at 0.07MB per second.

So, with all the different options and servers, making a selection boils down to three criteria: your machine, your needs and your abilities. When it comes to servers, Apache is an 800-pound gorilla that can do almost anything. Its extensibility through a variety of modules has made it the most common Web server on the market. If you're not looking to run a hosting service for Web developers on a laptop, Lighttpd's smaller size and simplicity could fill the bill. When it comes to Linux distributions, the three factors to take into consideration are size, simplicity and speed. If you are looking for speed, explore Vector Linux. If ease and simplicity are your highest priorities, try Xubuntu. If space is a problem, consider Damn Small Linux.

If you want a the fastest Web server that is also mobile, combine TeamSpeak with Lighttpd on Vector Linux. If you want to display LAN-party score results or serve pictures and short videos while maintaining communication with teammates anywhere in the world, or if you want to have a central meeting place and wiki or content management system with a few people around the globe, then Lighttpd, TeamSpeak and Vector Linux are right for the job.

Even though they have slower hardware, old laptops definitely can be used in place of desktops—so long as you don't expect very heavy loads. Figure out your priorities of speed, simplicity and size in distributions; then simplicity or speed in servers; and finally, simplicity, frugality and speed in VoIP. Resurrect ye old laptop, blow off the dust, and give it new purpose in life.■

Joseph Quigley has been a Linux user for three years. He enjoys fiddling with different Linux distros and exploring new programming languages.

Resources

JoeDog's Siege: **www.joedog.org/JoeDog/Siege**

"5-Minute Introduction to PostreSQL Performance": **www.westnet.com/~gsmith/content/postgresql/pg-5minute.htm**

Optimizing the MySQL Server: **dev.mysql.com/doc/refman/5.0/en/optimizing-the-server.html**

MySQL Installation Using a Source Distribution: **dev.mysql.com/doc/refman/5.0/en/installing-source.html**

Building a LAMP Server, by Bruce Timberlake: **lamphowto.com**

Ubuntu Team Wiki: **https://wiki.ubuntu.com**

Apache HTTP Server Version 1.3: **httpd.apache.org/docs/1.3**

Lighttpd: **trac.lighttpd.net/trac/wiki/Docs**

XAMPP: **www.apachefriends.org/en/xampp.html**

Tutorial: Setting up the TeamSpeak 2 Server on Linux: **www.teamspeak.com/index.php?page=tutorial_b**

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Quake, Meet GPL; GPL, Meet *Quake*

What has spiders, bubble gum, rocket launchers and camo pants? *Quake 3*, of course!

SHAWN POWERS

Back in the summer of 2005, id Software released the *Quake 3* engine to the public under the GPL license. For open-source enthusiasts, it was amazing news, but to the general public, it seemed like mostly marketing nonsense. Releasing the *Quake 3* engine, unfortunately, wasn't the same as releasing the game, so the average gamer didn't gain anything—at least, not at first. In this article, I introduce some great new games that use the *Quake 3* engine. They're all free, and they all run natively under Linux.

First, let's talk about what id Software really did when it released the engine under the GPL. As Linux users, we're familiar with terms like, "Free as in speech and free as in beer". For the record, I have never understood the latter part of that motto. Beer is rarely free. Nonetheless, the *Quake 3* engine is indeed free in several ways:

- The program is free to download. You don't have to pay for it, and it's not crippled in any way whatsoever. You can give it to your friends, for free, and you won't be a pirate. (This is the "free as in beer" part.)
- The program is free to modify, change, repackage and even sell—provided you include your source code. (This is the "free as in speech" part.)
- The engine is not the whole game. You can't install the program and expect to frag your little brother in the next room. The graphics, models, maps and such are not free. If you distribute those things (from the retail *Quake 3* CD), you, in fact, will be a pirate. That part is not free.

I tried to explain the significance of releasing the engine to non-techie friends of mine, but, alas, they had no idea what I was talking about. So, for those of you who have never really understood the whole game engine versus actual game thing, check out the "Grandma's GPL Cookie Recipe" sidebar.

My Gaming System

Before I begin talking about the games, I have a few confessions to make. First, I'm not a gamer. I am the player you want on the opposite team in pretty much any gaming situation. I'm horrible. Second, my computer is just about as adept at gaming as I am. Here are the specs:

- Pentium 4 2.4GHz
- Onboard Intel 915 graphics (shared 8MB memory)
- 20GB IDE hard drive
- 512MB of RAM
- Ubuntu Linux 7.04

I chose Ubuntu because it's very common and easy to use. It doesn't really matter what distribution you have; they'll all work, but some of my examples might not look exactly the same. I'll try to be as generic as possible.

One key issue with getting any 3-D game working is to make sure you're using an accelerated driver in the X Window System. It's possible your computer already has this. A simple way to check is to open a terminal window and type:

```
# glxinfo | grep endering <enter>
```

And, look for:

```
# direct rendering: Yes
```

(I purposefully left off the r in the grep statement, in case the word Rendering happened to be capitalized.) If you don't have direct rendering, you need to configure your video card for acceleration before you can run any of the games covered in this article. In my case, I had to change my video driver to "intel" instead of "i810". You might have to do some research on the type of card you have. Most semi-modern video cards are capable of acceleration in Linux, so it likely will be worth the effort. Now that you (hopefully) have your video system running properly, let's get down to the games!

Open Arena

This first game is basically an attempt to re-create *Quake 3 Arena*, but with free graphics, models and so on. If you ever played *Quake 3 Arena*, *Open Arena* will look very familiar. Because it uses the new-and-improved engine (ioQuake3, based on the original *Quake 3* engine), I think it's actually more fun than the original. Don't tell id.

For Ubuntu users, simply type the following to install *Open Arena*:

```
# sudo apt-get install openarena
```

If you are using a distribution that doesn't have a package available, you can download the zip file from **www.openarena.ws**, and follow the simple directions for installation. (Basically, unzip the files, and start the executable for your architecture. It's pretty simple.)

Once you start the game, you first need to configure things. Because my video card is on the slow side of pokey, I set my resolution to 640x480, and most of the other details to low. Unlike some of the



Figure 1. Shawn Dying in *Open Arena*

other games, *Open Arena* has a single-player version. That's great news for me, because on the "I Can Win" setting, I actually can do fairly well. Figure 1 shows a screenshot of me dying (note that most of the screenshots in this article are of me dying—I'll pretend it's on purpose).

Open Arena is fun. It's fast, simple and you get to blow stuff up. Even though the game says it requires 16MB of video RAM, *Open Arena* ran extremely well on my 8MB system. It's the kind of game you can actually play during a television commercial and frag 20 people (or get fragged 20 times) before the show starts again.

Urban Terror

Urban Terror started as a game mod for the original *Quake 3*. I actually played it back when it required *Quake 3*, and apart from being more mature, the game play is very similar. The difference, of course, is that now it runs on the open-source ioQuake3 engine, so it's completely free. *Urban Terror* is designed to take the first-person-shooter-type game into an urban landscape. As creepy as that sounds, it actually makes for some interesting maps and allows for realistic firearms.

Urban Terror has the least-friendly Linux installer. If you read the installation instructions closely enough, it's not too difficult, but my suggestion is to use the handy-dandy installation script available on the forums (see Resources). One important installation note is that if you run the installer as root, the game will be accessible by all the users on your computer. It's also important to follow the directions on the forum post. If you do so, it will download all the needed files, create icons and download some common maps.

Urban Terror is a multiplayer game. Generally, this means you play

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Grandma's GPL Cookie Recipe

When id Software released the *Quake 3* engine in the summer of 2005, it wasn't the same as releasing the entire game for free. It was more like Grandma giving you her cookie recipe. Let's say Grandma had an incredible cookie recipe, and she sold cookies like crazy for five years. After five years, Grandma decided to give away her recipe. Sure, you could make your own cookies based on Grandma's recipe, but Grandma didn't actually send you any cookies in the mail. In fact, Grandma still sold her cookies, and people bought them.

The great part is that not only can you take Grandma's recipe, you also can add to it. You can make your own cookies and base the recipe on what Grandma gave you. That's pretty much what happened with the *Quake 3* engine. The only caveat with releasing a new cookie recipe is that you need to include your recipe for free as well. And, that's just how Grandma wants it.

on-line or set up a server and play on your local network. It is possible (although unsupported) to add bots to your server, so in theory, you could play alone. Not all maps support bots, and bots tend to cause random crashes. If you're like me, however, and can't hack it against real people on the Internet, it might be worth the effort. Because bots aren't officially supported, I'll leave it to the reader to add them (see Resources).

It's a little more complicated to jump into an *Urban Terror* game than playing a quick game of *Open Arena*. The weapon selection is done at the beginning of a round, and without doing some research, it's hard to tell which guns are best. I tend to stick with the default choice. I also tend to get shot a lot, so the default weapons might not be the best bet. Figure 2 shows an example of the realistic maps in *Urban Terror*.

Tremulous

Tremulous is an interesting game. It's kind of a cross between a first-person-shooter and a real-time strategy game. Although the game is played in first person, and indeed, you frag the other team, you also build devices and set up bases. Unlike most other first-person-shooter games, the two races in *Tremulous* are drastically different. The humans are, well, humans. The aliens, however, are spider-like and tend to attack without weapons. The idea behind *Tremulous* is really remarkable, and the two separate races make for radically different game play.



Figure 2. *Urban Terror*'s Realistic Maps

This is another game that is simple to install on Ubuntu. All it takes is a quick:

```
# sudo apt-get install tremulous
```

If you have a different distribution, **www.tremulous.net** supplies a generic installer. Honestly, installing *Tremulous* is painless. I wish I could say the same about actually playing the game.

Tremulous is hard—really, really, really hard. Unfortunately, there is no single-player version, nor is there any support for bots. The only way to play *Tremulous* is against other people. Other people, as a group, all tend to be better than I am. I played for more than an hour, both as a human and as an alien, and I didn't get a single kill—not a single one.

I'm sure there are other folks who understand the game better than I do, and I know there are other people who can play the game better than I do. Sadly, *Tremulous* is the game I was most excited about, and the game I enjoyed the least. No matter what race I chose, or what character I chose to play, I just couldn't get the hang of playing. Figure 3 shows me dying. So does Figure 4.

World of Padman

The last game on the list has many similarities to the first. *World of Padman* has the same sort of fast-action and easy-to-learn features that make *Open Arena* so great. The interesting twist is that *World of Padman* is staged in a cartoon-like, oddly proportioned environment. All the players are tiny mouse-sized, and the "maps" are generally rooms in a house. I absolutely love the graphics, and apart from a few annoyances, it is easily the most visually appealing of the four.

Although *World of Padman* isn't distributed as a package for Ubuntu, the installer is very easy to use. On its Web site, **www.worldofpadman.com**, it even offers a live DVD version of the game. (Actually, several games are on the DVD.) Once the installer was done, I did have one small issue. It wouldn't start. When I started from the command line, I could see the game was complaining it didn't have libvorbisfile installed. After I installed it (`sudo apt-get install libvorbisfile3`), the game started just fine. I was a little surprised the installer didn't check for stuff like that, but all in all, it wasn't too hard to fix.

World of Padman is demanding on the video card. Even with details and resolution turned way down, I still could tell the video card was holding me back. In high-action scenes, like the one shown in Figure 5, the screen started to stutter. As the requirements mention

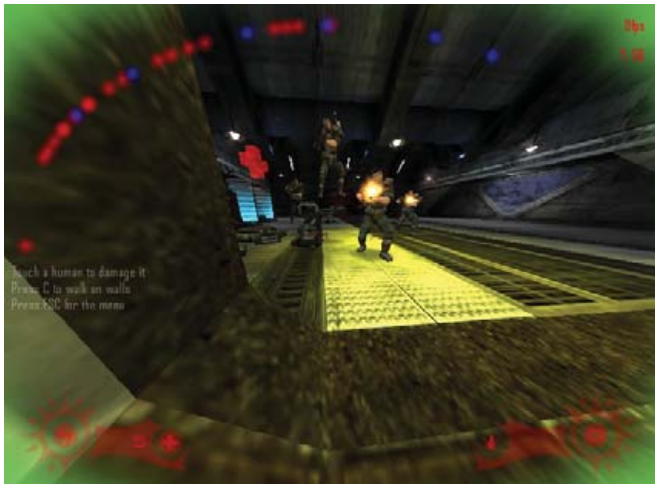


Figure 3. Shawn Dying in *Tremulous*



Figure 4. Shawn Dying Again in *Tremulous*

a need for a 128MB OpenGL video card, I guess I can't complain that my 8MB shared memory video was a bit underpowered. The game was still very playable, even with my system.

This game is pure fun. The weapons range from a water-balloon launcher to a bubble-gum gun. The maps are extremely detailed and enjoyable to explore. My only real complaint is with the pictures on the main menu and on the loading screen. A game that would otherwise be perfect for young gamers quickly becomes inappropriate due to the sexually explicit cartoons. If there were a G-rated version of the game, I would install it for my kids to play and use it for the after-school gaming club at our school. Unfortunately, it's a little to risqué for such an environment.

Also, although the single-player mode isn't yet complete, *World of Padman* has excellent bots. If you have a poor Internet connection or poor gaming skills, it's possible to have tons of fun with a local server full of bots. Honestly though, *World of Padman* is easy enough that while playing on-line, I actually fared quite well. Although I really enjoyed *Open Arena*, I think *World of Padman* might be my favorite game of the bunch.

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- 2X10/100/1000 LAN onboard.
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- 2X10/100/1000 LAN onboard.
- 930w Red PS.



8U Woodcrest/Clovertown Storage server Starts at - $ 11,191



- 10TB Storage installed. Max - 30TB.
- 8U Dual core 5050 CPU.
- 2X5050 installed.
- 1GB 667MGZ FBDIMMs.
- Supports 32GB FBDIMM.
- 40X250GB htswap SATA-II Drives installed.
- 2X12 Port SATA-II Multilane RAID controller.
- 1X16 Port SATA-II Multilane RAID controller.
- 2X10/100/1000 LAN onboard.
- 1850 W Red Ps.

All systems installed and tested with user's choice of Linux distribution (free). ASA Collocation—$75 per month

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SUMMARY

Open Arena

- Ease of installation: very easy (on Ubuntu)
- Video performance: worked well on a low-end system
- Single-player mode: yes
- Bots in multiplayer mode: yes
- Pros: fast, easy to learn
- Cons: ?

Urban Terror

- Ease of installation: moderate (must follow directions!)
- Video performance: played okay on a low-end system
- Single-player mode: no
- Bots in multiplayer mode: yes, but unsupported (buggy)
- Pros: detailed urban setting, realistic weapons
- Cons: slightly steep learning curve

Tremulous

- Ease of installation: very easy (on Ubuntu)
- Video performance: played okay on a low-end system
- Single-player mode: no
- Bots in multiplayer mode: no
- Pros: innovative idea, complex gaming system
- Cons: hard to play (at least for me)

World of Padman

- Ease of installation: moderate (see article for glitch)
- Video performance: struggled on a low-end system
- Single-player mode: not yet (in development)
- Bots in multiplayer mode: yes
- Pros: fun, silly, fast and easy to learn
- Cons: sexually suggestive imagery limits user base



Figure 5. High-Action Scene in *World of Padman*

Grandma Would Be Proud

I own the retail version of *Quake 3 Arena*. After running these new games, however, I have to admit I don't foresee myself playing the old one anymore. id released its game engine, and that allowed developers to concentrate on some really innovative additions. I'm truly amazed at the quality of these games.■

Shawn Powers is a geeky Technology Director for a small school in northern Michigan. He did manage to find a wife to love him and has three wonderful daughters. His wife even watches *Star Trek* with him, but he suspects it's just because she loves him. Send e-mail to him at shawn@brainofshawn.com.

Resources

id Software: **www.idsoftware.com**

ioQuake3: **www.ioquake3.org**

Ubuntu Linux: **www.ubuntulinux.org**

Open Arena: **www.openarena.ws**

Urban Terror: **www.urbanterror.net**

Tremulous: **www.tremulous.net**

World of Padman: **www.worldofpadman.com**

Urban Terror Linux Installer:
www.forums.urbanterror.net/index.php/topic,8165.0.html

Urban Terror Bot Information:
www.forums.urbanterror.net/index.php/topic,8053.0.html

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JULY 29, 2008, SAN JOSE, CA, USA

17th USENIX Security Symposium (USENIX Security '08)

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8th USENIX Symposium on Operating Systems Design and Implementation (OSDI '08)

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http://www.usenix.org/osdi08
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Get Organized with Emacs Org-mode

Use Emacs to create a flexible plain-text organizer and personal productivity system.

ABHIJEET CHAVAN

It is said that Emacs, that versatile toolbox for working with text, is more than merely a text editor—it's a lifestyle. That's not just hyperbole. In this article, I show you how to turn Emacs into a flexible personal organizer and productivity system.

I started using Emacs for programming but soon discovered that it worked well for nonprogramming writing tasks too. I began experimenting with several modes that extend Emacs for writing notes and planning projects. Though each one was useful in its own way, none of these features or modes fit my style of working. Then I discovered Org-mode.

Org-mode is a new Emacs mode developed by Carsten Dominik. It is designed for taking notes, outlining, writing, project planning, maintaining to-do lists, time management and even publishing to Web sites—all this using only Emacs and plain text.

Plain text? Why would anyone want to use plain text for doing all of the above? Plain text offers several advantages. You are not locked in to a file format or an operating system. You can edit plain-text files using any available text editor. It is easy to copy and paste plain text from and into e-mail messages. You can track changes in your document using a version control system, such as CVS or Subversion. When I am writing, I find that plain text offers one more advantage—it enables me to think better and focus on my ideas, without the distractions of a word processor.

Getting Started with Org-mode

For this article, I assume that you have Emacs installed and have some familiarity with using it. If you are not already an Emacs user, maybe Org-mode will give you a good reason to start using it. (See Resources for information on getting started with Emacs.)

Org-mode is included in GNU Emacs 22. You also can install Org-mode to work with GNU Emacs 21 and XEmacs. I used GNU Emacs 22 and Org-mode 4.42 to write this article. If you already have Emacs on your system, check whether Org-mode is available by typing the following command:

```
M-x org-mode
```

The above notation means press the meta key (Esc or Alt, depending on your setup) followed by x, followed by `org-mode`, and then press the Return (or Enter) key.

If Emacs displays "No Match", it means you do not have Org-mode installed. You will need to install org-mode manually or install GNU Emacs 22. You can find precompiled binaries of GNU Emacs 22 for your Linux distribution and even for other operating systems. On Ubuntu 7.04 (Feisty Fawn), you can install GNU Emacs 22 (with Org-mode 4.56d) by running the following command:

```
sudo apt-get install emacs-snapshot
```

If you need to install Org-mode for GNU Emacs 21 or XEmacs, download the latest version from **orgmode.org**, and look for the manual that provides detailed installation instructions. (The Org-mode documentation includes an excellent manual with more than 100 pages and a handy reference card.) Once you have org-mode installed, run the `M-x org-mode` command again. If Org-mode is installed correctly, Emacs will display "(Org)" in its mode line area, and Org-mode will be active. If you are running Emacs in a graphical environment, you also should see the Org pull-down menu (Figure 1).



Figure 1. Graphical User Interface Menu for Org-mode

Although Org-mode provides a graphical menu, in this article I refer to Org-mode keyboard commands only. Once you get familiar with Org-mode keystrokes, you will find them to be more efficient than the graphical menu.

Add the following lines to your ~/.emacs file and restart Emacs:

```
;; Org-mode settings
(add-to-list 'auto-mode-alist '("\\.org$" . org-mode))
(global-set-key "\C-cl" 'org-store-link)
(global-set-key "\C-ca" 'org-agenda)
(global-font-lock-mode 1)
```

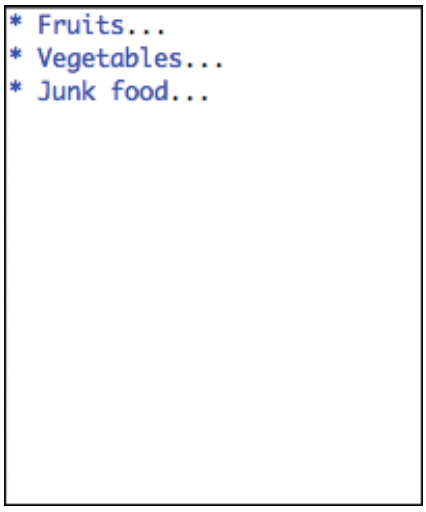


Figure 2. Outline Overview



Figure 3. Outline Partially Expanded

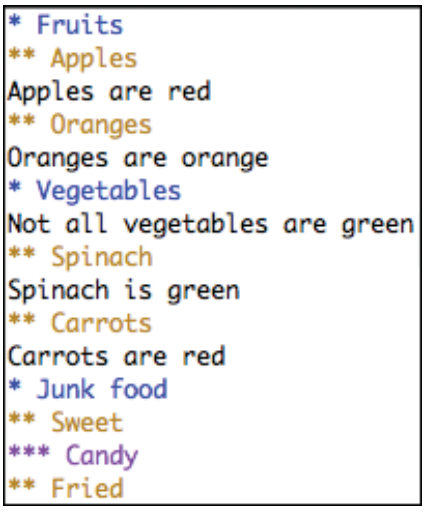


Figure 4. Outline Fully Expanded

Now, if you save your org files with the .org extension, they will open up using Org-mode in Emacs. I recommend creating a directory to keep all your Org files. I use ~/notes. Although you can invoke org-mode for any text file, it's convenient to have them in one directory.

Outlining and Writing

Outlining is an effective technique for organizing thoughts, taking notes or writing articles. Emacs has a built-in outline-mode that stores text as entries. Each entry has a headline and a body. Entries can be nested to create a tree of hierarchical information. Emacs uses asterisks (stars) to denote the hierarchy of an outline tree. Lines that do not begin with a star are considered to be the body of the headline above it. In the following example, `** Apples` is a headline. `Apples are red` is the body for the Apples headline.

```
* Fruit
** Apples
Apples are red
** Oranges
Oranges are orange
*Vegetables
```

Branches of a tree can be folded and hidden from view to make it easier to navigate the tree and work on specific parts of the tree. When a headline is folded, its body and subtree (all branches) are hidden from view, and the headline is displayed ending with ellipses (three dots).

Outline Structure

Org-mode is based on Emacs' outline-mode, but it makes working with outlines much easier. Place the cursor on a headline. Using the Tab key, you can expand the headline to show its branches and body. Using Shift-Tab does the same for the entire document (Figures 2–4).

Org-mode provides useful keystrokes for modifying the outline structure. To promote a heading by one level, place the cursor on the heading, and use the keystroke M-left (meta and left arrow keys together). To demote a heading by one level use M-right. You can promote an entire subtree with M-Shift-left (Meta, Shift and left arrow keys together) and demote it with M-Shift-right.

It is designed for taking notes, outlining, writing, project planning, maintaining to-do lists, time management and even publishing to Web sites—all this using only Emacs and plain text.

Plain Lists

Sometimes you may need to add a plain list within the body of a subtree that is not part of the tree structure of the document. To add an unordered plain list, start the line with - or +. To make Org-mode add a - or + at the start of subsequent list items automatically, use M-Return to insert the next list item. To add an ordered list, start the line with `1.`, and to make Org-mode number subsequent items automatically, use M-Return to insert the next list item. Add an item in the middle of an ordered list, and Org-mode automatically renumbers

```
* Ordered and unordered lists
1. First ordered list item
 - First unordered list item
 - Second unordered list item
   + Another item
   + Yet another item
2. Second ordered list item
 - [ ] This is a unchecked checkbox
 - [X] This is a checked checkbox
 - [ ] This is another unchecked checkbox
3. Third ordered list item
```

Figure 5. Plain Lists

the list items. You can mix ordered and unordered lists too. Want to add check boxes to a plain list? Start the list item with `-[ ]`. You can toggle the check box using C-c C-c, which displays the check box as `[X]` (Figure 5).

Hyperlinks

Org-mode recognizes URLs and turns them into clickable links. If Emacs knows your default Web browser, clicking on URLs in Org-mode opens up the link in your default Web browser. Org-mode supports other types of external links, including links to files and images (Figure 6).

```
* Hyperlinks
** Simple URLs
http://staff.science.uva.nl/~dominik/Tools/org/
** Link to image
file:images/example.png
** Link to file
file:files/example.pdf
```

Figure 6. Hyperlinks

Tables

Org-mode includes a table editor that makes it possible to format tables in plain ASCII text. Using | as a column separator, Org-mode automatically reformats the plain-text table to realign columns or add new rows. Use Tab to move to the next cell and Shift-Tab to move to the previous cell. Org-mode helpfully right-aligns numbers. You can do spreadsheet calculations in these plain-text tables by inserting formulae within cells (Figure 7).

```
* Tables

| Column 1   | Column 2   | Column 3   | Numbers |
|------------+------------+------------+---------|
| Cell one   | Cell two   | Cell three |       1 |
| Cell four  | Cell five  | Cell six   |     200 |
| Cell seven | Cell eight | Cell nine  |    3001 |
|------------+------------+------------+---------|
|            |            |            |    3202 |
#+TBLFM: $4=vsum(&1-3)
```

Figure 7. Plain-Text Tables

These are just a few examples of how Org-mode makes it easy to write and format in plain text. But Org-mode's most impressive features are those that enable you to organize and track tasks.

Tags

You can assign tags to any headline. Tags are simply letters or numbers preceded and followed by a colon. For example, `:RED:` could be a tag. You can associate multiple tags with a single headline as in `:RED:GREEN:`. Tags are added to the end of a headline. To add a tag to a headline, place the cursor on the headline and type `C-c C-c`. Org-mode will prompt you for a tag.

Org-mode creates a dynamic list of all tags in the file. If you already have tags in a file and want to tag a headline, Org-mode presents a list of already-entered tags. After typing `C-c C-c` on a headline, use the up and down arrow keys to see other tags in use.

```
* Fruits
** Apples                                   :RED:GREEN:...
** Oranges                                  :ORANGE:...
* Vegetables
Not all vegetables are green
** Spinach                                  :GREEN:...
** Carrots                                  :RED:...
* Junk food...
```

Figure 8. Tags

Tags can be used to set up a system of labels to relate and group information spread out across an Org file. You could use tags to mark the activity type, such as `:CODE:` and `:CALL:`. If you are coordinating tasks with others, you could use colleagues' names as tags.

Work Flow and To-Do Lists

In Org-mode you can create a to-do list in the same file that you are using to write notes or outline a project. This has the advantage of placing the task in the context of the entire project. To mark a headline as a to-do item, start the headline with the word `TODO`. You can do this more quickly by placing the cursor on the headline and typing in `C-c C-t`. This adds the label `TODO` to the start of the headline for you. The same command can be used to toggle the `TODO` to `DONE` when you complete the task. Use the command once again, and Org-mode removes `DONE` from the headline.

`TODO` and `DONE` are the standard work-flow states in Org-mode, but it's possible to configure your own work flow, either globally for all Org-mode files or a custom one for each file. For example, if you wanted to set up a custom work flow, such as `TODO --> TEST --> DONE`, add the following to the top of your Org file:

```
#+SEQ_TODO: TODO TEST DONE
```

Priorities

Once you create tasks, you will need to prioritize them. Org-mode supports three priority levels: A, B and C. A is the highest priority. Priority for a task can be set by adding `[#A]` to a headline. The command `C-c` also can be used to set priorities. Figure 9 shows an example of a task list using tags, a custom to-do work flow and priorities.

```
#+SEQ_TODO: TODO TEST DONE

** TODO [#C] Wash car                        :CAR:
** DONE [#B] Purchase lightbulb              :BUY:
** TEST [#A] Replace lightbulb               :FIX:
```

Figure 9. Tags, Custom To-Do Work Flow and Priorities

Tags, custom work flows and priorities, make Org-mode flexible enough for many different uses. It's easy to develop a custom organization system that suits a project. Each Org file can use a different system.

Timestamps

To associate an event or a meeting with a date in Org-mode, use a plain timestamp. You can insert a plain timestamp in headlines or the

Emacs has a built-in outline-mode that stores text as entries.

body of an entry with `C-c`. You also can specify date ranges. Org-mode provides special timestamps useful for scheduling and tracking tasks. To set a reminder to start working on an entry on a certain date, precede the timestamp with the label `SCHEDULED`. If an entry is to be completed by a certain date, precede the timestamp with the label `DEADLINE`. You also can use Org-mode for tracking time spent on each task. This is done by using the `CLOCK` label preceding the timestamp. Org-mode has keyboard commands to make it easy to insert timestamps and timestamp labels.

Example

Figure 10 shows a fictional example that illustrates some of Org-mode's planning and scheduling features. This Org file uses a custom to-do work flow, which is specified at the top of the file. Task are marked with work-flow states. Major project phases are outlined some with scheduled or deadline dates. Tags are used for marking activity type and team member responsibilities. Dates and times are marked for meetings. A clock timestamp is used to track time spent on a meeting. The "On-site Meetings" entry uses a date range because it spans multiple days. High and low priority markers help prioritize tasks. Folded away from view are the project proposal, meeting minutes, reports and a budget spreadsheet. Everything related to a project can be kept in one file.

```
#+SEQ_TODO: TODO ACTIVE DONE

* Project Proposal
** DONE Write Proposal
   SCHEDULED: <2006-01-16 Mon>
   DEADLINE: <2006-01-23 Mon>
*** Proposal Outline                          :WRITE:...
** DONE [#A] Submit project proposal          :EMAIL:
   DEADLINE: <2006-01-25 Wed>
* Prepare Requirements & Budget
** DONE Team Meeting <2006-02-15 Wed 10:30>   :MTG:PAT:RAVI:TIM:
   CLOCK: [2006-02-15 Wed 10:30]--[2006-02-15 Wed 11:45] =>  1:15
*** Meeting Agenda                            :EMAIL:
*** Meeting minutes...
** DONE On-site Requirement Meetings          :RAVI:PAT:
   <2006-02-22 Wed>--<2006-02-24 Fri>
** DONE Requirements Report                   :PAT:...
** DONE [#A] Finalize requirements
   DEADLINE: <2006-03-10 Fri>
** TODO [#A] Finalize Budget
    DEADLINE: <2006-03-17 Fri>
*** ACTIVE [#A] Budget Spreadsheet...
* Development
** Team Meeting <2006-04-06 Thu 9:00>         :MTG:PAT:RAVI:TIM:
*** TODO [#C] Meeting Agenda
```

Figure 10. Project Planning with Org-mode

Tag Searches

Since Org files can get large, Org-mode provides mechanisms to generate different views of an Org file showing only the information you are interested in. In Figure 10, if you want to search for all entries with the tag `PAT`, use the command `C-c \` and type in `PAT` (Figure 11).

Agenda Views

Org-mode's Agenda feature offers other views, such as a list of all to-do items or an agenda-like display of entries and their dates. First, you need to

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Infitech www.infi-tech.com	17, 19	Super Micro Computer, Inc. www.supermicro.com	55
Intel www.intel.com	C2	Technologic Systems www.embeddedx86.com	67
King Star Computer www.kingstarusa.com	61	Uniwide Technologies www.uniwide.com	11
LinuxCertified, Inc. www.linuxcertified.com	85	USENIX www.usenix.org/events/usenix07	77

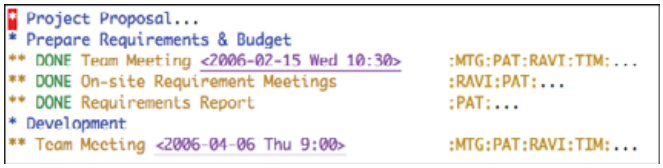


Figure 11. Tag Searches

add your Org file to your Org agenda by using the command `C-c [`. Then, type `C-c a` to be presented with options for different views. For example, to see a to-do list of the fictional project shown in Figure 10, type `C-c a t` (Figure 12). You also can generate views based on tags (Figure 13).

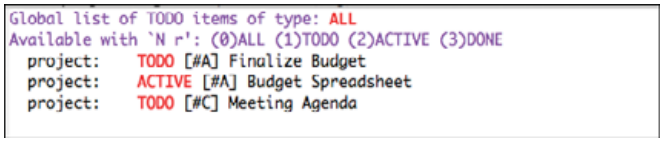


Figure 12. Agenda To-Do List



Figure 13. Agenda Tag List

Exporting and Publishing

Org-mode files are readable, and you can copy and paste the text directly from the Org file into e-mail messages or other documents. You also can export from Org-mode to other file formats. To export an Org file to formatted ASCII text file with a contents page and automatically numbered headings, use the command `M-x org-export-as-ascii`. Org-mode generates a file with the same name as the Org file, but with a .txt extension. To export as HTML, use the command `M-x org-export-as-html`, and Org-mode creates a file with a .html extension. The HTML version will have a hyperlinked contents page, numbered headings, formatted tables, hyperlinks and images, if any (Figure 14).

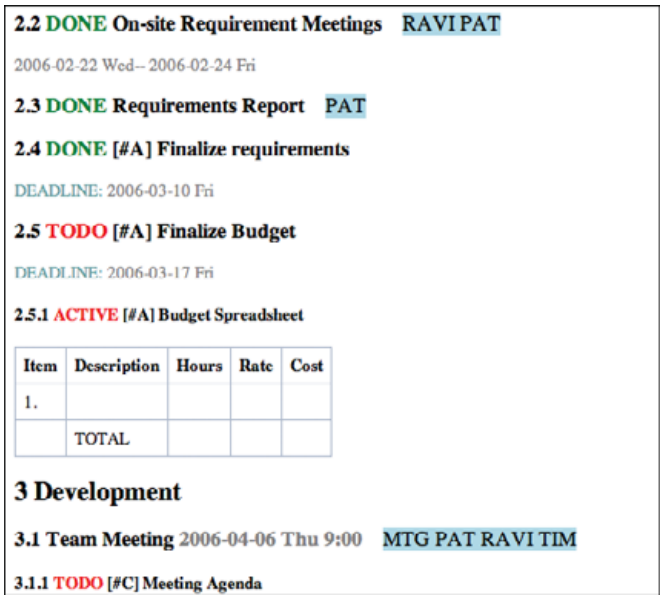


Figure 14. Org File Exported to HTML Format

Conclusion

I have covered only some of the features Org-mode offers using a single Org file as an example, but there is more to Org-mode. You can maintain multiple Org files and generate agenda views or to-do lists across Org files. Entries can be archived. Org-mode also includes a publishing system to generate a set of interlinked HTML files automatically and upload them to a server. Much of Org-mode's behavior can be customized. Org-mode builds on top of Emacs' core features. It also provides hooks to interact with other Emacs modes and packages. It also can be used to implement David Allen's "Getting Things Done" method for personal productivity (see Resources). I find Org-mode invaluable for taking notes, planning projects, tracking tasks and organizing ideas.

Using only plain-text for writing, organizing, planning, and scheduling may appear to be a quixotic goal. Org-mode meets the challenge and delivers a practical, intuitive, and elegant solution.■

Abhijeet Chavan is the Chief Technology Officer of Urban Insight, an Internet consulting firm (urbaninsight.com). He also is the cofounder and co-editor of Planetizen (planetizen.com). He wrote this article using Org-mode.

Resources

Emacs Wiki: **www.emacswiki.org**

GNU Emacs: **www.gnu.org/software/emacs**

Org-mode Web Site: **orgmode.org**

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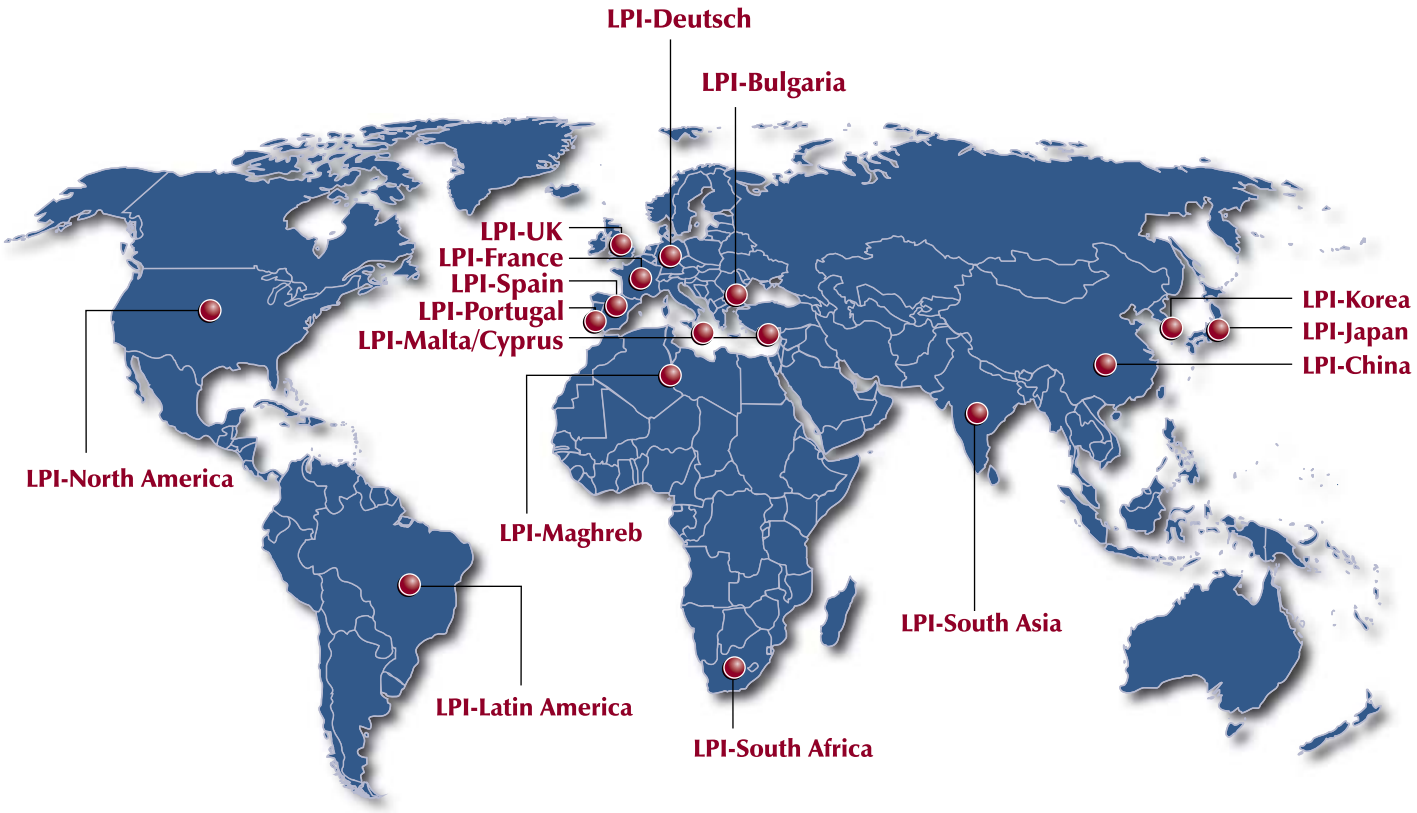
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Grubby Gems

Three great stocking stuffers for kids of all ages.

DANIEL BARTHOLOMEW

Wanting to know more about the company and what makes it tick, I sat down (in a virtual sense) with Grubby Games' cofounder and programmer Ryan Clark.

DB: Thanks for agreeing to this interview. First off, how long has Grubby Games been around, and perhaps more to the point, how long have you been making Linux games?
RC: Grubby Games was founded in 2004, and we've been making Linux games the entire time.

DB: What about the games available for sale on your site that run only on Windows and/or the Mac platform?
RC: The games on our site that do not run on Linux were created by other developers; we sell those games as affiliates. All of the games we have developed (and will develop) run on Linux.

DB: That's good to hear! What led to your decision to support Linux with all of your offerings?
RC: We chose to make Linux games because I personally always have wished that there were more games for Linux. It seems that others share my sentiment, as we have received a number of e-mails from Linux users, thanking us profusely for making our games available for Linux. (We also get our share of comments from Linux users who are angry because our games are not free/open source!)

DB: Do you think you might ever release your games or any of your animation/rendering or other libraries under an open-source license? I'm thinking of something along the lines of what id did with *Doom* and *Quake* when after the commercial benefit of the games had passed, they released the source code to the engine (but not the levels themselves) under an open-source license.
RC: I hope we'll be able to do that at some point, yes. However, we already do it in a manner of speaking, through another Web site we run: The Game Programming Wiki (**gpwiki.org**).

I've written a number of articles for the wiki, many of which describe the exact same methods I use in our games. And on the GPWiki forums, I do my best to answer any questions people may have.

DB: I'll have to check that out. What percentage of your sales come from Linux versions of your games?
RC: About 2%, although I do know that a number of people have purchased Windows or Mac versions of our games because they want to (indirectly) support our Linux efforts.

DB: Good for them! Do you think the market is ready for more commercial Linux game studios?
RC: It's hard to say. We certainly wouldn't be able to afford to do what we do if we were Linux-only. However, I do think that more studios should consider making Linux versions of their games. Many already support Windows and Mac; it's not much harder to support Linux too. Not supporting Linux is just like throwing away money.

DB: So, at least for now, is the cross-platform approach the best way to go?
RC: As I said, we certainly couldn't survive on the money we currently make from the Linux versions of our games. However, we're definitely not reaching all of the potential Linux customers that we could be.

If we're currently reaching only 2% of potential Linux customers, then yes, we could survive by making Linux-only games, if we could somehow reach 100% of them. And I'm confident that we're probably reaching less than 2%, at present. But how do you reach the rest of them? We haven't found any cost-effective way to do it. Expensive advertising campaigns surely would help expand our reach, but likely would not benefit our bottom line.

DB: How much of your code is fully cross-platform?
RC: More than 99%. We have platform-specific code only for a few things, like locating a good place to store user profile data, or opening a Web browser.

DB: How hard is it to support all three OS platforms simultaneously?
RC: Really not that hard. The tricky bit is not the coding, it's the deployment on each platform. But even the deployment is easy once you find a system that works well for you. With each release, it becomes easier and more automatic for us.

DB: Do you have any games currently in development that you can tell us about?
RC: We have three games in development, but they are all in their very early stages, so we're not quite ready to divulge any secrets. But, I can tell you that they'll all run on Linux, of course. We're branching out in a few new directions, so expect to see some cool new stuff.

DB: I'm excited to see them! Are you the head programmer/only programmer on these new games?
RC: I was the only programmer when we started in 2004, but we now have three programmers on staff. Programmers work on their own games; we feel that it's more efficient to run three projects with one programmer each than one project with three programmers.

DB: All three of your current games ship with a ton of levels. How do you decide when you have created enough levels and are ready to ship?
RC: We usually aim for a certain minimum amount of play time. (We want to make sure our customers feel like they got good value for their money.) As a result, our games tend to have a minimum of about six hours of game play. If you are superhuman, and you play through all the levels without any sort of hiccup, you can finish our games in around that amount of time.

In reality, our games will last much longer than that, of course. I seriously doubt anyone could solve all of the *Professor Fizzwizzle* or *Professor Fizzwizzle and the Molten Mystery* levels in less than a full-time week. The games also provide replay value through high-score systems, trophies or level editors with downloadable levels made by other users.

DB: Speaking of the level editors, was their inclusion a planned feature from the get-go, or was it a "well, it's built, so we might as well include it" kind of thing?
RC: A level editor just felt like a natural addition. If people enjoy solving puzzles, some percentage of them also will enjoy creating puzzles. It was an easy way to add replayability to the games, and a way to build community.

Also, we just really wanted to see what people would come up with. I was very pleased the first time someone stumped me at my own game.

DB: Are any of you still creating levels for the games and posting them on-line, or are you all too busy creating the next great Grubby Games game?
RC: I check out levels created by the community, but I rarely post new ones myself. As you say, we are very busy working on the next batch of games.

DB: Seeing as your games run on the big three OS platforms, which one do you do your primary development on?
RC: Our first game, *Professor Fizzwizzle*, was developed entirely on Linux. Since then, we've moved over to Mac OS X. The reason for the move is Parallels Desktop. Parallels allows us to run Windows and Linux as virtual machines, from Mac OS X. As a result, we can develop and test for all three platforms on one machine, without needing to reboot—very handy.

DB: Very handy indeed—I'm a big fan of virtualization myself. On a slightly related note, I do have to say that my favorite game of the three is *FizzBall*. When you were in the planning stages, how did you come up with the idea for this game? It's a wonderfully crazy cross between *Katamari Damacy* and *Breakout*.
RC: Matt and I are both huge fans of *Katamari Damacy*, so I think it influences our thinking somewhat. We're also fans of *Breakout*/*Arkanoid*, but felt that there were a few major shortcomings of the genre: the "last brick problem", and the "lack of control" problem.

The "last brick problem" is likely familiar to you: you've got one brick left in *Breakout*, but you can't quite seem to hit it—so frustrating! We feel we solved this problem in a number of ways. First, the *Katamari*-ness of *FizzBall* means that the ball grows over time. The large end-game ball makes it easier to hit any target you might be aiming at. Second, since you're supposed to be rescuing animals rather than breaking things, you don't actually have to destroy everything on the level.

The "lack of control" problem lies in the pinball-like nature of *Breakout*: after you hit the ball, you have nothing to do until it comes back down. We addressed this problem by introducing "fans" that allow you to alter the ball's trajectory while it is in flight. This allows skilled players to achieve large combos, collect hard-to-get trophies, and it makes *FizzBall* less of a "waiting game" than traditional *Breakout* titles.

In fact, to find the best level designers, we simply chose from the players who already were submitting *Professor Fizzwizzle* levels to our Web site!

DB: Yes, you did solve both of those issues quite well, and I'm working my way through the last few trophies. Finally, I wanted to ask you about who created the levels on *Professor Fizzwizzle* and *Professor Fizzwizzle and the Molten Mystery*? Some of them (especially the ones in the advanced level sets) are insanely hard! I'm almost convinced that you have a secret team of psychotic chess geniuses on your staff.
RC: Matt and I created almost all of the levels for *Professor Fizzwizzle*, even the advanced ones. It was a challenge to make so many levels, but a lot of fun too. For *Professor Fizzwizzle and the Molten Mystery*, we hired



level designers to help us. In fact, to find the best level designers, we simply chose from the players who already were submitting *Professor Fizzwizzle* levels to our Web site! Jarod and Lior did an amazing job for us.

DB: Yes they did. Thanks for taking the time to talk with us today.

RC: Thanks Daniel! It's been fun.

The Games

With the interview over, it was time to kick my kids off of my computer and discover for myself what these games do right, and what they don't.

Grubby Games' current trio of games can be split into two types. First, there's *Professor Fizzwizzle* (*PF*) and its sequel, *Professor Fizzwizzle and the Molten Mystery* (*PFMM*). Both are puzzle games where the object is to get the Professor from the starting point to the ending point utilizing various gadgets and objects along the way.

Second, there's *FizzBall*, which is completely different. It is an arcade-type game in the *Arkanoid* tradition with very little in the way of puzzle solving.

All three of the games are suitable (and fun) for all ages, from 3–103.

Purchasing the Games

Because I so seldom purchase Linux software, it felt weird when I bought the games. Despite the strange "I'm buying a game for Linux!" feeling, the actual process was very easy. Essentially, it's the same as purchasing anything else on-line. Your receipt and the games themselves are delivered to you via special links that are sent to you by e-mail.

The games range in size from 10–20MB, so if you're on a slow Internet connection, you may want to leave the downloads running overnight so that they'll be finished and waiting for you in the morning. I was able to download them in just a few minutes.

After the download is complete, you will have a .tar.gz file (or two or three) sitting in front of you waiting to be unpacked.

Installation and First Run

The games are distributed as .tar.gz files, and untarring them is how they are installed. I put mine into /usr/local/share/games/grubby/, but they could live anywhere on your system.

Start the games using a shell script called `run.sh` on *PF* and *FizzBall*. On *PFMM*, the game is started with script called `run.cmd`. It would have been nice if all three were named consistently. A graphical shell script installer of some sort, like CrossOver Office, would be another alternative. Quibbles aside, the .tar.gz method will, at least, work almost everywhere.

One of the first things I did after unpacking the files was to create some launchers for my GNOME panel, so that I didn't have to launch the games from the command line. The icons included are ugly, at least they're there.

Launch the games from the command line the first time you run them, just to be sure they're working properly. When run in this way, you will get some helpful diagnostic output in your terminal if things aren't quite right. In the case of *PF*, you *must* launch the game from the command line the first time, because it asks you which sound system and driver to use. I'm very glad the two more recent games have eliminated this step.



Figure 1. One of the Kid Levels from *PFMM*

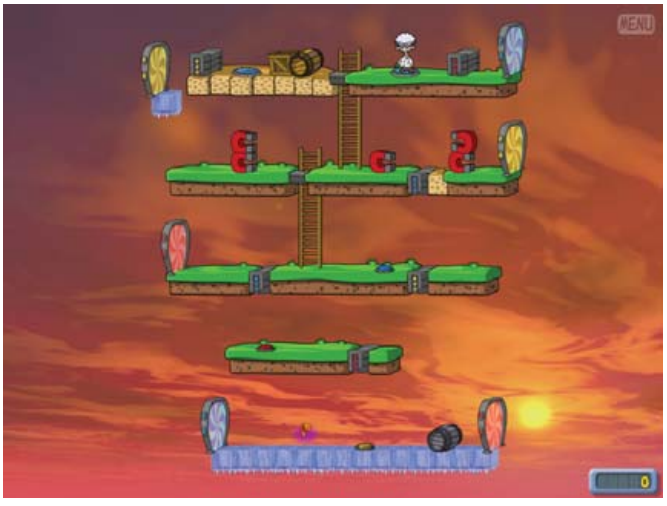


Figure 2. One of the Advanced Levels from *PFMM*

I think the command-line oriented installation process on all three of these games, although relatively painless for me, could be a big stumbling block to non-technical Linux users. Additionally, such a manual install process is out of character with the otherwise very good-looking games. I hope they come up with a better method for future games.

There also were some libraries I had to install on my Ubuntu 7.04 box to get the games to work right: zlib1g-dev and libpng3 for *FizzBall* and libsdl-ttf2.0-0 for *PFMM*.

Installation and library issues aside, once the games are up and running, they look and sound great. They're all very polished—exactly what I expect from games I paid real money to get.

Game Play

Each game starts up into an easy-to-use menu system that you can navigate either with your mouse or keyboard. The Preferences section of each game lets you set things like whether to play full-screen or in a window, the volume of music and sound effects and so on. Everything is simple and well organized.



Figure 3. The *PFMM* Level Editor



Figure 5. The ball starts out small in *FizzBall*...

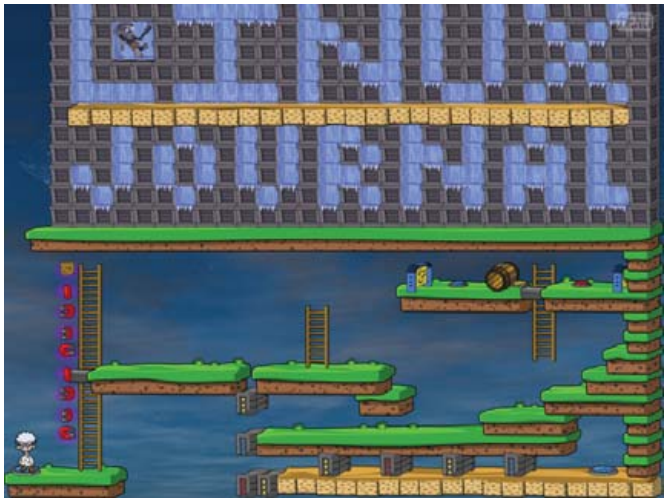


Figure 4. My *Linux Journal* Level



Figure 6. ...but it keeps growing the more animals you catch.

Professor Fizzwizzle

The focus of the two *Professor Fizzwizzle* games is on puzzle solving. The easiest, or "kid's" levels, are basic runs from one side of the screen to the other, often with neat pictures built out of different level parts filling the screen.

The other levels are divided into "regular" and "advanced". These range from fairly easy to nearly impossible.

The replayability of individual levels in each of these games is not very high, because once you know how to beat a level, you easily can do so at any future time (unless, of course, you're like me and forget). Thankfully, the games come with enough levels to keep you busy for a *long* time. What keeps my children coming back to these two games are the level editors built into each one.

My kids spend hours fiddling and perfecting their levels, and I have to say, I'm impressed with the sophistication of some of their best ones. I've even taken a stab at level design myself and came up with a *Linux Journal*-themed level that, although not very hard to beat, was still fun to make.

I've uploaded my level to the Grubby Games Web site, so feel free to give it a try.

If you are more action-oriented than puzzle-oriented (like me), give *FizzBall* a try.

FizzBall

If you are more action-oriented than puzzle-oriented (like me), give *FizzBall* a try. The object in this game is to collect all the animals. There are crates and rocks and trees and even aliens in your way. You play by bouncing your fizzball off of these obstacles while making sure you don't let the ball get past you.

At the start of a level, your fizzball is

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small and can pick up only nuts, apples and butterflies. As you collect more food and animals, your ball gets bigger and bigger, allowing you to collect even larger animals. Everything literally snowballs, and by the end of the level, you should have a pretty substantial fizzball bouncing around the screen collecting animals and destroying every crate and fence that gets in the way. You beat levels by collecting all the animals.

The game has a ton of power-ups to keep things interesting, and there also are special achievements you can collect for beating levels in a certain way.

One of my favorite features is that the kid difficulty level has a bumper along the bottom of the screen that prevents you from losing your fizzball. This makes the game playable even for very young children.

Conclusion

You can't go wrong with any of these games. If I had to choose between *Professor Fizzwizzle* and *Professor Fizzwizzle and the Molten Mystery* I would go with the latter, simply because it has more gadgets, harder puzzles and a better level editor. However, if I could choose only one of the three, I would choose *FizzBall*.

There are demos of the games at the Grubby Games Web site, so you can try before you buy. If you do decide to purchase one or more of them, I can honestly say that they're all worth the price. Games are $19.94 each, but there's a $5 discount if you bundle more games with your purchase. Now, if you'll excuse me, there's this one level that I have to get back to....■

Daniel Bartholomew lives with his wife and children in North Carolina. He can be found on-line at his occasionally updated blog: ubuntu-watch.com.

Resources

Grubby Games: **www.grubbygames.com**

Extra Levels for *Professor Fizzwizzle*: **grubbygamesfiles.com/pf_levels**

Extra Levels for *Professor Fizzwizzle and the Molten Mystery*: **grubbygamesfiles.com/pfmm/levels**

The Game Programming Wiki: **gpwiki.org**

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MySQL 5 Stored Procedures: Relic or Revolution?

Stored procedures bring the legacy advantages and challenges to MySQL.

GUY HARRISON

Stored procedures (or stored routines, to use the official MySQL terminology) are programs that are both stored and executed within the database server. Stored procedures have been features in closed-source relational databases, such as Oracle, since the early 1990s. However, MySQL added stored procedure support only in the recent 5.0 release and, consequently, applications built on the LAMP stack don't generally incorporate stored procedures. So, this is an opportune time to consider whether stored procedures should be incorporated into your MySQL applications.

Most of the functions for which stored programs were used in client-server applications now can be implemented in middle-tier code (PHP, Java, C# and so on).

Stored Procedures in the Client-Server Era

Database stored programs first came to prominence in the late 1980s and early 1990s, during the client-server revolution. In the client-server applications of that time, stored programs had some obvious advantages:

- Client-server applications typically had to balance processing load carefully between the client PC and the (relatively) more powerful server machine. Using stored programs was one way to reduce the load on the client, which might otherwise be overloaded.
- Network bandwidth was often a serious constraint on client-server applications; execution of multiple server-side operations in a single stored program could reduce network traffic.
- Maintaining correct versions of client software in a client-server environment was often problematic. Centralizing at least some of the processing on the server allowed a greater measure of control over core logic.
- Stored programs offered clear security advantages because, in those days, application users typically connected directly to the database, rather than through a middle tier. As I discuss later in this article, stored procedures allow you to restrict the database account only to well-defined procedure calls, rather than allowing the account to execute any and all SQL statements.

With the emergence of three-tier architectures and Web applications, some of the incentives to use stored programs from within applications disappeared. Application clients are now often browser-based, security is predominantly handled by a middle tier, and the middle tier possesses the ability to encapsulate business logic. Most of the functions for which stored programs were used in client-server applications now can be implemented in middle-tier code (PHP, Java, C# and so on).

Nevertheless, many of the traditional advantages of stored procedures remain, so let's consider these advantages, and some disadvantages, in more depth.

Using Stored Procedures to Enhance Database Security

Stored procedures are subject to most of the security restrictions that apply to other database objects: tables, indexes, views and so forth. Specific permissions are required before a user can create a stored program, and, similarly, specific permissions are needed in order to execute a program.

What sets the stored program security model apart from that of other database objects—and from other programming languages—is that stored programs may execute with the permissions of the user who *created* the stored procedure, rather than those of the user who is *executing* the stored procedure. This model allows users to perform actions via a stored procedure that they would not be authorized to perform using normal SQL.

This facility, sometimes called definer rights security, allows us to tighten our database security, because we can ensure that a user gains access to tables only via stored program code that restricts the types of operations that can be performed on those tables and that can implement various business and data integrity rules. For instance, by establishing a stored program as the only mechanism available for certain table inserts or updates, we can ensure that all of these operations are logged, and we can prevent any invalid data entry from making its way into the table.

In the event that this application account is compromised (for instance, if the password is cracked), attackers still will be able to execute only our stored programs, as opposed to being able to run any ad hoc SQL. Although such a situation constitutes a severe security breach, at least we are assured that attackers will be subject to the same checks and logging as normal application users. They also will be denied the opportunity to retrieve information about the underlying database schema (because

the ability to run standard SQL will be granted to the procedure, not the user), which will hinder attempts to perform further malicious activities.

Another security advantage inherent in stored programs is their resistance to SQL injection attacks. An SQL injection attack can occur when a malicious user manages to "inject" SQL code into the SQL code being constructed by the application. Stored programs do not offer the only protection against SQL injection attacks, but applications that rely exclusively on stored programs to interact with the database are largely resistant to this type of attack (provided that those stored programs do not themselves build dynamic SQL strings without fully validating their inputs).

Data Abstraction

It is generally a good practice to separate your data access code from your business logic and presentation logic. Data access routines often are used by multiple program modules and are likely to be maintained by a separate group of developers. A very common scenario requires changes to the underlying data structures while minimizing the impact on higher-level logic. Data abstraction makes this much easier to accomplish.

The use of stored programs provides a convenient way of implementing a data access layer. By creating a set of stored programs that implement all of the data access routines required by the application, we are effectively building an API for the application to use for all database interactions.

Reducing Network Traffic

Stored programs can improve application performance radically by reducing network traffic in certain situations.

It's commonplace for an application to accept input from an end user, read some data in the database, decide what statement to execute next, retrieve a result, make a decision, execute some SQL and so on. If the application code is written entirely outside the database, each of these steps would require a network round trip between the database and the application. The time taken to perform these network trips easily can dominate overall user response time.

Consider a typical interaction between a bank customer and an ATM machine. The user requests a transfer of funds between two accounts. The application must retrieve the balance of each account from the database, check withdrawal limits and possibly other policy information, issue the relevant UPDATE statements, and finally issue a commit, all before advising the customer that the transaction has succeeded. Even for this relatively simple interaction, at least six separate database queries must be issued, each with its own network round trip between the application server and the database. Figure 1 shows the sequences of interactions that would be required without a stored program.

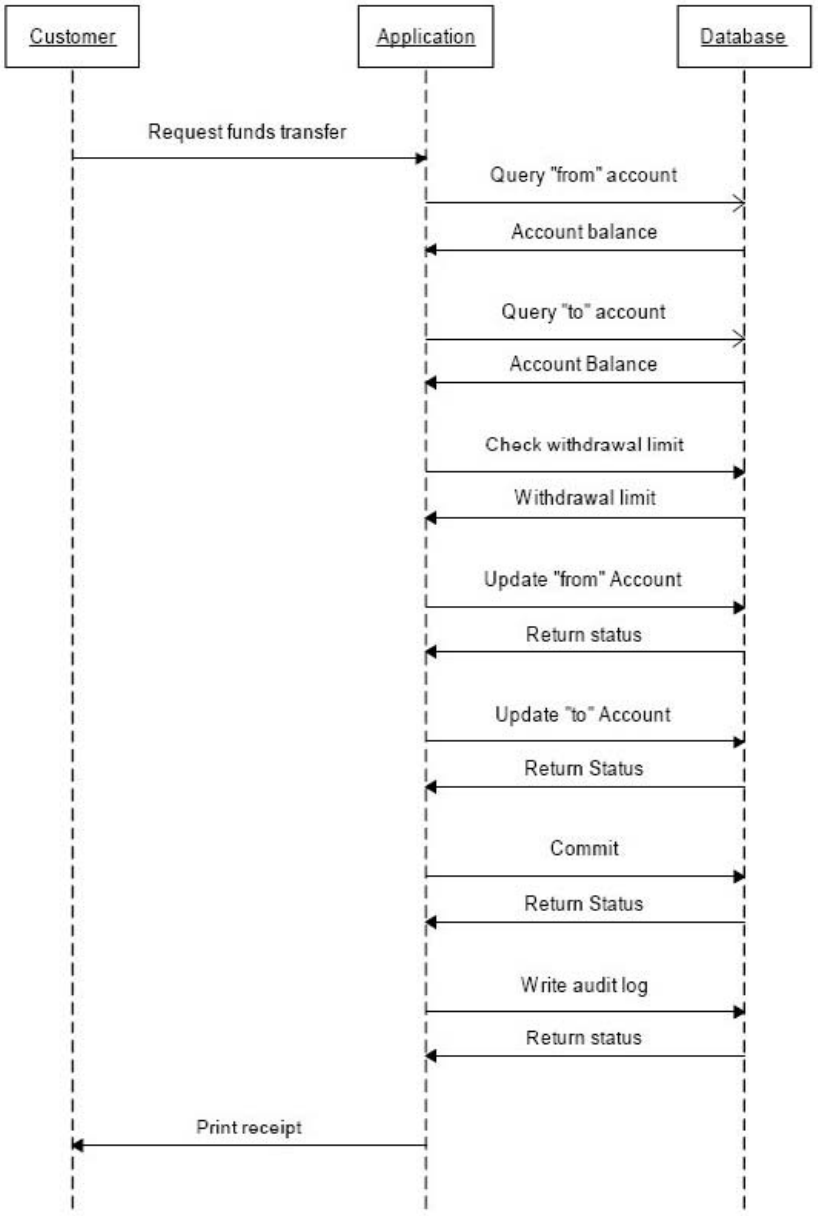


Figure 1. Network Round Trips without Stored Procedure

On the other hand, if a stored program is used to implement the fund transfer logic, only a single database interaction is required. The stored program takes responsibility for checking balances, withdrawal limits and so on. Figure 2 shows the reduction in network round trips that occurs as a result.

Network round trips also can become significant when an application is required to perform some kind of aggregate processing

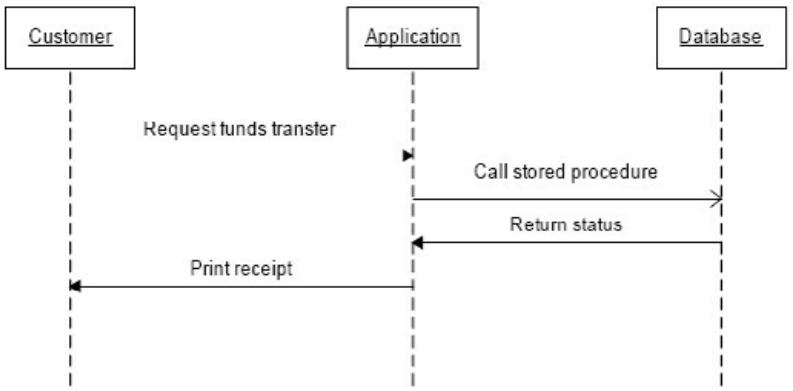


Figure 2. Network Round Trips with Stored Procedure

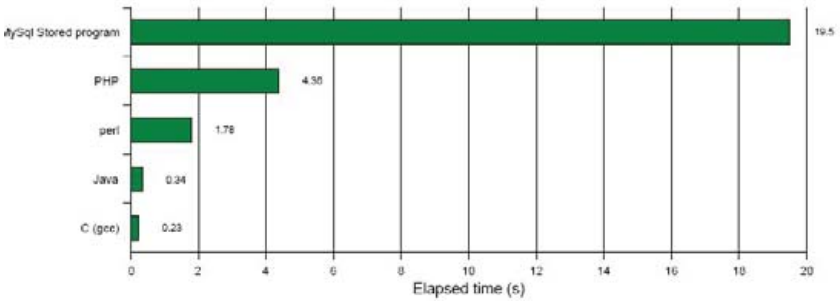


Figure 3. Stored procedures are a poor choice for number crunching.

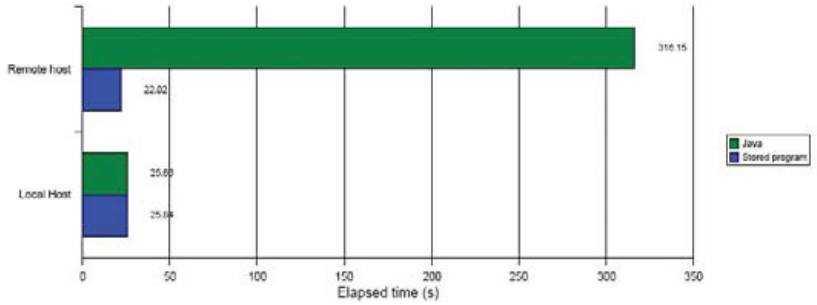


Figure 4. Stored procedures outperform when the network is a factor.

This model allows users to perform actions via a stored procedure that they would not be authorized to perform using normal SQL.

on very large record sets in the database. For instance, if the application needs to retrieve millions of rows in order to calculate some sort of business metric that cannot be computed easily using native SQL, such as average time to complete an order, a very large number of round trips can result. In such a case, the network delay again may become the dominant factor in application response time. Performing the calculations in a stored program will reduce network overhead, which might reduce overall response time, but you need to be sure to take into account the differences in raw computation speed, which I discuss later in this article.

Creating Common Routines across Multiple Applications

Although it is commonplace for a MySQL database to be at the service of a single application, it is not at all uncommon for multiple applications to share a single database. These applications might run on different machines and be written in different languages; it may be hard, or impossible, for these applications to share code. Implementing common code in stored programs may allow these applications to share critical common routines.

For instance, in a banking application, transfer of funds transactions might originate from multiple sources, including a bank teller's console, an Internet browser, an ATM or a phone banking application. Each of these applications could conceivably have its own database access code written in largely incompatible languages, and without stored programs we might have to replicate the transaction logic, including logging, deadlock handling and optimistic locking strategies, in multiple places and in multiple languages. In this scenario, consolidating the logic in a database stored procedure can make a lot of sense.

Not Built for Speed?

It would be terribly unfair of us to expect the first release of the MySQL stored program language to be blisteringly fast. After all, languages such as Perl and PHP have been the subject of tweaking and optimization for about a decade, while the latest generation of programming languages—.NET and Java—has been the subject of a shorter, but more intensive optimization process by some of the biggest software companies in the world. So, right from the start, we might

Stored programs can improve application performance radically by reducing network traffic in certain situations.

expect that the MySQL stored program language would lag in comparison with the other languages commonly used in the MySQL world.

Still, it's important to get a sense of the raw performance of the language. First, let's see how quickly the stored program language can crunch numbers. The first example compares a stored procedure calculating prime numbers against an identical algorithm implemented in alternative languages.

In this computationally intensive trial, MySQL performed poorly compared with other languages—five times slower than PHP or Perl, and dozens of times slower than Java, .NET or C (Figure 3).

Most of the time, stored programs are dominated by database access time, where stored programs have a natural performance advantage over other programming languages because of their lower network overhead. However, if you are writing a number-crunching routine, and you have a choice between implementing it in the stored program language or in another language, such as PHP or Java, you may wisely decide against using the stored program solution.

If the previous example left you feeling less than enthusiastic about stored program performance, this next example should cheer you right up. Although stored programs aren't particularly zippy when it comes to number crunching, it is definitely true that you don't normally write stored programs simply to perform math; stored programs almost always process data from the database. In these circumstances, the difference between stored program and PHP or Java performance is usually minimal, unless network overhead is a big factor. When a program is required to process large numbers of rows from the database, a stored program can substantially outperform programs written in client languages, because it does not have to wait for rows to be transferred across the network—the stored program runs *inside* the database. Figure 4 shows how a stored procedure that aggregates millions of rows can perform well even when called from a remote host across the network, while a Java program with identical logic suffers from severe network-driven response time degradation.

Logic Fragmentation

Although it is generally useful to encapsulate data access logic inside stored programs, it is usually inadvisable to "fragment" business and application logic by implementing some of it in stored programs and the rest of it in the middle tier or the application client.

Debugging application errors that involve interactions between stored program code and other application code may be many times more difficult than debugging code that is completely encapsulated in the application layer. For instance, there is currently no debugger that can trace program flow from the application code into the MySQL stored program code.

Also, if your application relies on stored procedures, that's an additional skill that you or your team will have to acquire and maintain.

Object-Relational Mapping

It's becoming increasingly common for an Object-Relational Mapping (ORM) framework to mediate interactions between the application and the database. ORM is very common in Java (Hibernate and EJB), almost unavoidable in Ruby on Rails (ActiveRecord) and far less common in PHP (though there are an increasing number of PHP ORM packages available). ORM systems generate SQL to maintain a mapping between program objects and database tables. Although most ORM systems allow you to overwrite the ORM SQL with your own code, such as a stored procedure call, doing so negates some of the advantages of the ORM system. In short, stored procedures become harder to use and a lot less attractive when used in combination with ORM.

Are Stored Procedures Portable?

Although all relational databases implement a common set of SQL syntax, each RDBMS offers proprietary extensions to this standard

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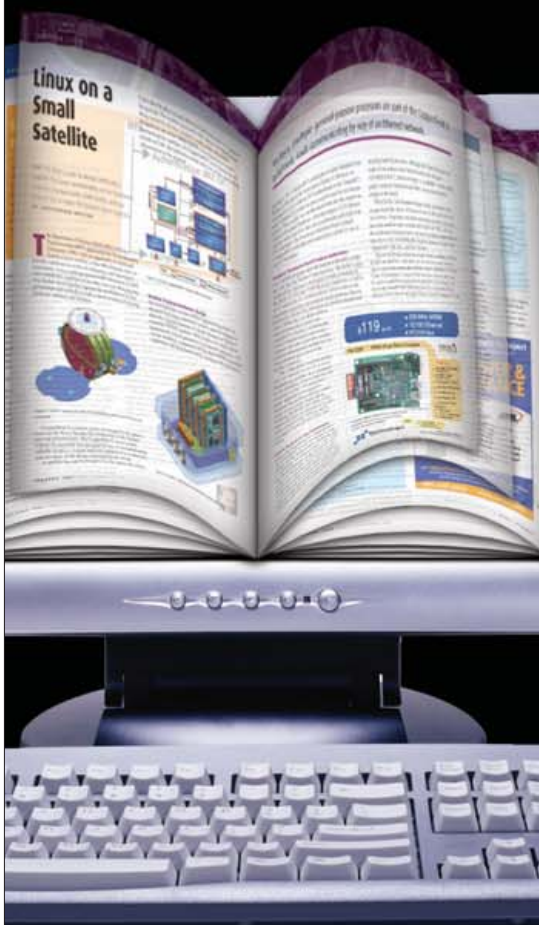
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When a program is required to process large numbers of rows from the database, a stored program can substantially outperform programs written in client languages, because it does not have to wait for rows to be transferred across the network—the stored program runs *inside* the database.

SQL, and MySQL is no exception. If you are attempting to write an application that is designed to be independent of the underlying database, you probably will want to avoid these extensions in your application. However, sometimes you'll need to use specific syntax to get the most out of the server. For instance, in MySQL, you often will want to employ MySQL hints, execute non-ANSI statements, such as LOCK TABLES, or use the REPLACE statement.

Using stored programs can help you avoid RDBMS-dependent code in your application layer while allowing you to continue to take advantage of RDBMS-specific optimizations. In theory, stored program calls against different databases can be made to look and behave identically from the application's perspective. You can encapsulate all the database-dependent code inside the stored procedures. Of course, the underlying stored program code will need to be rewritten for each RDBMS, but at least your application code will be relatively portable.

However, there are differences between the various database servers in how they handle stored procedure calls, especially if those calls return result sets. MySQL, SQL Server and DB2 stored procedures behave very similarly from the application's point of view. However, Oracle and Postgres calls can look and act differently, especially if your stored procedure call returns one or more result sets.

So, although using stored procedures can improve the portability of your application while still allowing you to exploit vendor-specific syntax, they don't make your application totally portable.

Other Considerations

MySQL stored programs can be used for a variety of tasks in addition to traditional application logic:

- Triggers are stored programs that fire when data modification language (DML) statements execute. Triggers can automate denormalization and enforce business rules without requiring application code changes and will take effect for all applications that access the database, including ad hoc SQL.
- The MySQL event scheduler introduced in the 5.1 release allows stored procedure code to be executed at regular intervals. This is handy for running regular application maintenance tasks, such as purging and archiving.
- The MySQL stored program language can be used to create functions that can be called from standard SQL. This allows you to encapsulate complex application calculations in a function and then use that function within SQL calls. This can centralize logic, improve maintainability and, if used carefully, improve performance.

You Decide!

The bottom line is that MySQL stored procedures give you more options for implementing your application and, therefore, are undeniably a "good thing". Judicious use of stored procedures can result in a more secure, higher performing and maintainable application. However, the degree to which an application might benefit from stored procedures is greatly dependent on the nature of that application. I hope this article helps you make a decision that works for your situation.■

Guy Harrison is chief architect for Database Solutions at Quest Software (www.quest.com). This article uses some material from his book *MySQL Stored Procedure Programming* (O'Reilly 2006; with Steven Feuerstein). Guy can be contacted at guy.harrison@quest.com.



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The Power of the Individual, Modeled by Open-Source Development

Are Linux geeks leading the way to long-awaited business reform?

DOC SEARLS



Somewhere in the massive oeuvre of Peter Drucker, the late great management guru reminds us that the modern corporation is a new breed of institution, hardly much older than our oldest human beings. The largest members of that breed, he said, hold just three main advantages over individuals: global communication reach, access to capital and provision of benefits, such as health care and office space. He also said that two of those three advantages are mostly gone, and the third might also go away.

But, will there be a reciprocal rise in the power of individuals? Progress in open-source code development suggests the answer.

Throughout his long career, Drucker often compared employees to skilled musicians and managers to orchestra conductors. But, that was an ideal. Reality was different. In a 1996 interview, he said:

> When big business first emerged throughout the industrial world around 1870, it did not emerge out of the small businesses of 1850—it emerged independently. The only model available, the most successful organization of the 19th century, was the Prussian Army....The Prussians succeeded because they had created an organization. They were the first ones to use modern technology effectively, which in those days meant railroad and telegraph. Business copied the command and control structure of the Prussian Army, in which rank equaled authority. We are now evolving toward structures in which rank means responsibility but not authority. And in which your job is not to command but to persuade.

Recent business lingo has grown beyond the vocabulary of command and control to include those of manufacture and capital as well. Employees are no longer workers but "human resources" and "assets". By any label, they're still org-chart filler on the ranking model of armies everywhere.

But, the world is still changing to one that favors corporate gigantism less and less. In his book *The World Is Flat*, Tom Friedman named open source as one of ten "flatteners" that are changing the world from one dominated by large governments and corporations to one where anybody anywhere can contribute to whatever he or she likes.

I think it helps that skilled programmers and other technical experts tend not to think of themselves as soldiers, resources, assets or org-chart filler of any kind. Instead, they regard themselves as skilled and useful contributors—and not just to their employers' missions, whatever those happen to be.

It's a cliché to talk about technology "changing the world", and technologists as "change agents" or "innovators". But change and innovation both veer away from a deeper point. Open-source code creators are not here to change the world as much as they're here to make that world in the first place, and then to create and improve the tools and building materials we need to build a free and open civilization on top of that world.

The new world is the Net. Linux set root and grew there, and now supports tools and building materials in countless hundreds of thousands of varieties—perhaps millions if we count hardware as well. Contributing to those code bases is like contributing to nature itself. The difference is that nature's primary building materials are limited to the portfolio of elements in the periodic table. Even when we're working with wood, or life forms transformed by death and time into fossil rocks and fuels, there are finite limits to both the source DNA and the final sum of supply. Not so with constructive works of the human mind.

It is interesting to note how modest and simple the motivations are behind the creation and improvement of essential infrastructural code such as Linux. Linus Torvalds titled his autobiography *Just for Fun*. On our last Linux Lunacy Geek Cruise, Andrew Morton was asked what he liked most about working on kernel code. "Stamping out bugs" was his reply. He also had a revealing answer to the question of whether Linux would be around 200 years from now. Andrew said, "yes". He also told me he expected Linux to prevail on desktops and laptops as well, in the fullness of time. I believe him.

There is an almost brutal meritocracy to the fun-making and bug-stomping of kernel code creation and re-creation. And, for that matter, to the building of less-familiar open-source code bases. You either contribute or you don't. And when you do, your satisfaction goes beyond the respect of your peers or the money you get from employers. It goes to knowing that you're contributing to the world itself.

There is a growing ironic distance between the vendor sports coverage that fills most tech media and the plain fact that companies are neither the architects nor the general contractors building this new world. Individuals are building this world, and they're doing it by working together on construction projects that in most cases do not conform to the shapes, or bear the names, of any company.

There is modeling here. Open-source code development is showing the way down the vector of progress that Peter Drucker talked about all his career. And, there is a limit to how much time will pass before the obvious advantages of freedom and practical merit outweigh as well as outperform what we used to think only companies could do.

Companies would be well advised to follow the lead of their best engineers, because those engineers are the ones building the world where all the world's technical creations and innovations are going to live.■

Doc Searls is Senior Editor of *Linux Journal*. He is also a Visiting Scholar at the University of California at Santa Barbara and a Fellow with the Berkman Center for Internet and Society at Harvard University.

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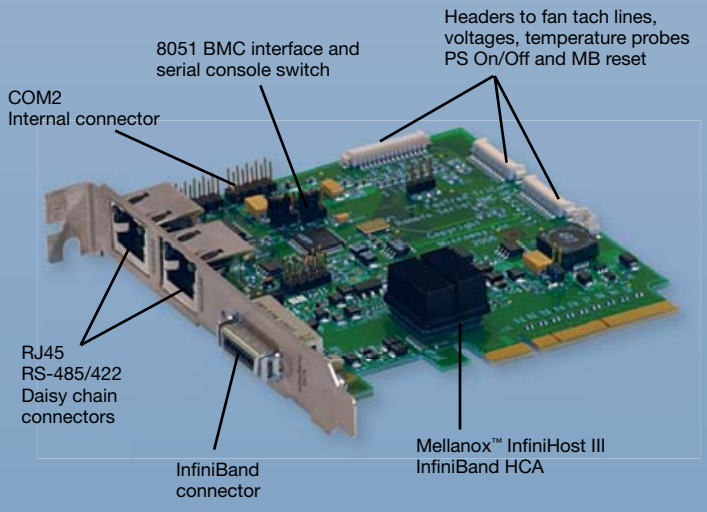
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